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CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. III, No. 2 TORONTO, FEBRUARY, 1919 20c. a copy.

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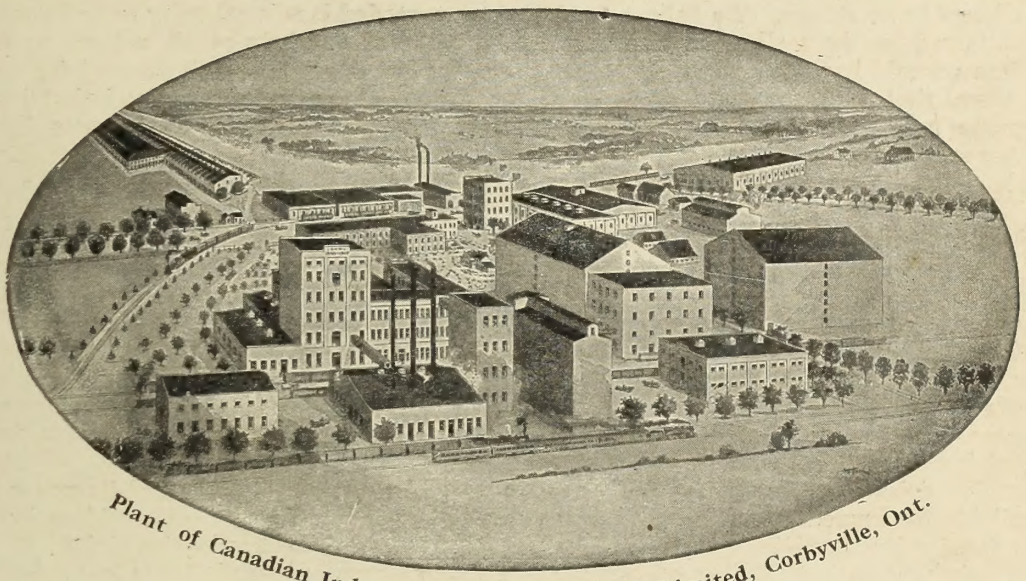

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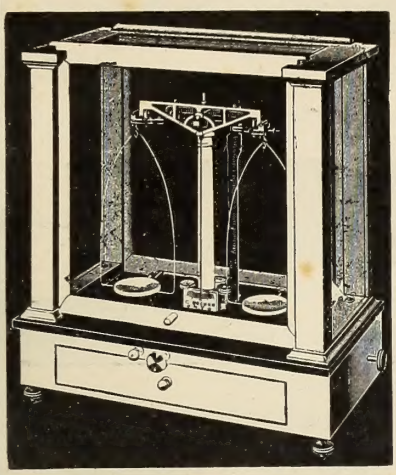

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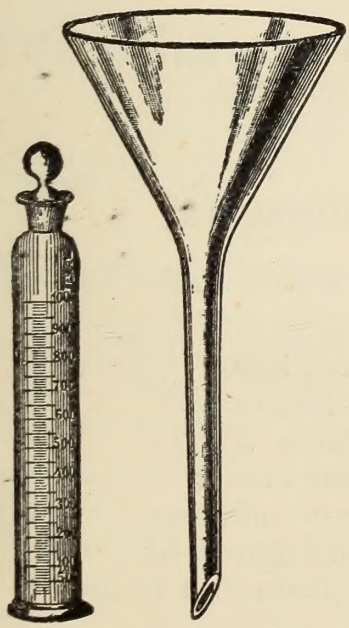

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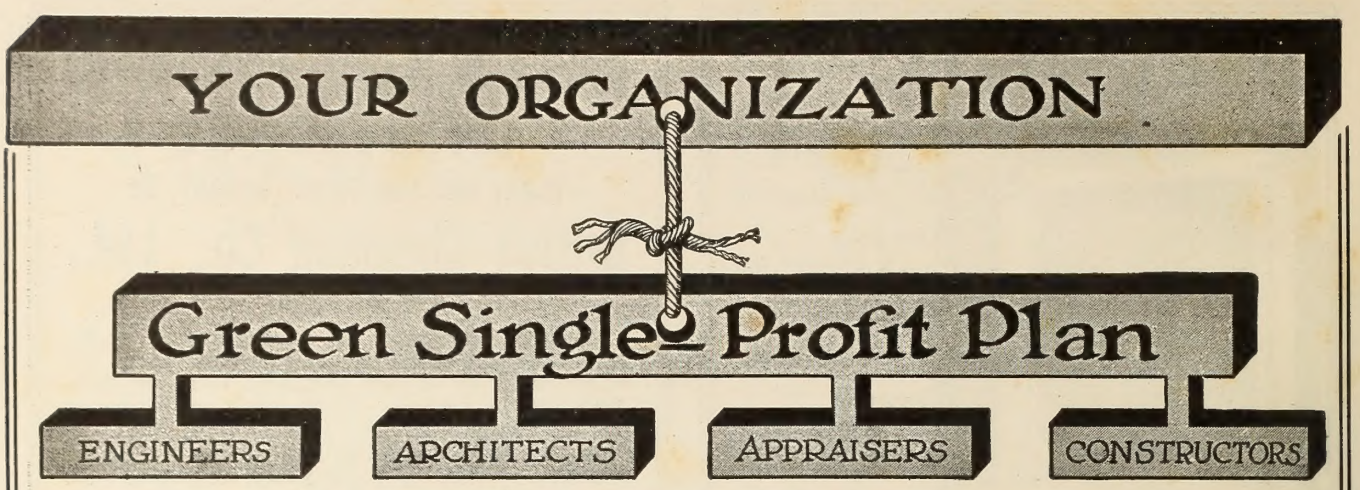

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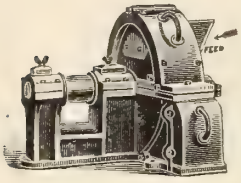

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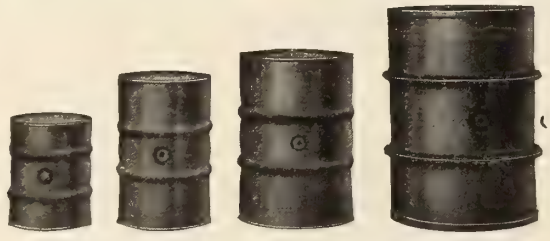

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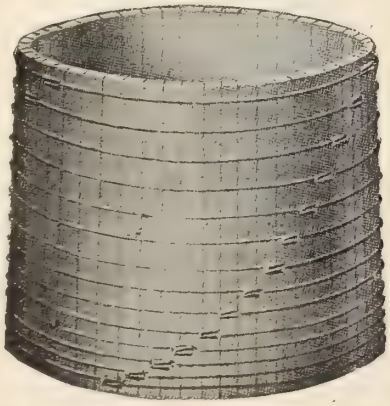

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All secretaries of chemical organizations are asked to supply the Journal with news regarding meetings held and resolutions passed.

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Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

MANUFACTURERS, THE RESEARCH COUNCIL AND CHEMISTS.

WE have had to deal with manufacturers and chemists seeking positions for many years. The Research Council, however, is a new factor. The general problem is one of co-operation. Each needs further organization and a more complete understanding of the inter-relationships which should exist one with the other. On all sides, there is a general lack of understanding which continually leads to either nonsensical lauding or equally foolish condemnation.

Business men in this country do not understand what the word "research" implies. It cannot be bought by the yard; neither can it be legislated into existence. The growth of results from research is at best an exceedingly slow process. Research has the elements of plodding, as well as genius. Its efforts must be sustained. It is never complete, but the tree brings forth fruit at odd seasons and never dies. Modern research involves the united work of specialists in many lines. It must have a leader and a staff to carry out his plans. Ample opportunities and facilities must be provided. A research man must have a special kind of initiative. For the production of results, we have plain, ordinary university graduates, some of whom have had some training in post-graduate work under professors who have had little industrial experience. It is the duty of the manufacturer to take on these men, giving them an opportunity to become acquainted with special plant practice, costs, markets, and many other everyday affairs. The men in turn will soon begin to get their feet and have suggestions. For the most part, the manufacturer must have faith equivalent to the faith of his research workers, and experience has shown that in every process there are possible improvements to be made and the beneficial results of the work accrue with time. Without this element of life, no new advances are possible. The research may fail in its direct aim, but generally most valuable secondary results are obtained.

The Honorary Advisory Research Council at Ottawa is directly and indirectly shouldering a large burden. It is bound in on all sides by limitations designed to destroy action and enthusiasm. There are few men elected to Parliament capable of appreciating the work such a body of men should do. If the work is worth doing, the members of active committees should be devoting their whole time to that work. "Advisory" covers a multitude of neglected possibilities for real action. Imagine our sending an "honorary advisory" army staff to France! Then why send such an organization to our industries? In a broad, general way, the work now in the hands of this Council will produce general results of value. Recent graduates may be assisted in research, and carried along in this atmosphere until such time as the true research spirit is born within themselves. The Research Council is a beautiful superstructure, whose chief aim for the present should be educational. We have little faith in doing things for the manufacturers which they will not do for themselves. They will never place this country on a par with the world's leaders, if they propose to go on using methods which supported their plodding efforts before the war. They must start things for themselves, and more than ordinary persuasive work is necessary before they will branch out and create new industries for Canada, or improve their processes. They must not get the idea that the Dominion Government is about to carry on all their research work, as well as that arising from the development of pure science, and our natural resources, for the whole people. We should not talk Mellon Institutes to men who never employed a chemist capable of standardizing a sulphuric acid solution.

At the present time, there are many chemists seeking positions. They have had varied training experiences. In general, experience in munition works' laboratories, or with the explosives industries does not naturally carry over to very many of the industries of peace. The men who left college may now return and postpone their search for regular positions. The graduates, however, are a problem. The Research Council has nothing for them. They cannot undertake special work at $700 a year, and our Canadian manufacturers are not in the habit of establishing laboratories or undertaking even the beginnings of research work under prevailing conditions. Lacking organization, the hands of the chemist are very weak at the moment. He must educate and plead, rather than direct or command. Other elements than professional ability are necessary. Perhaps the Government would be well advised to give such men further training along special lines, through the medium of fellowships at the universities. Many graduates would go in for industrial research at our universities if they were welcomed and given $1,200 a year. They would be training themselves for leadership later on. We have, however, poor machinery for doing much along these lines. The Research Council and chemists themselves should unite to undertake such an educational scheme as will bring chemistry to the public. While doing this, chemists themselves will learn many things that will greatly assist them in the part they play in industrial life.

Canadian industries must declare war immediately on everything within or without themselves which retards their scientific control or advance. Applied chemistry not only corrects industrial malpractice, but it also creates new life and guarantees sustained profits. As for chemists, if you employ one, call him a "research man" and give him a chance; if you are one, broaden out, get initiative, lead trump. Start something yourself and sustain it. If your organization does not provide for such a man, make it—this is the twentieth century.

ON THE POPULAR PRESENTATION OF CHEMISTRY TO THE DAILY PRESS.

BRITISH, and for that matter, all English-speaking, chemists have remained silent too long. Dr. Hodgson Ellis—a most honorable dean of Canadian chemists—gave utterance to a very significant truth when he stated recently before the Faculty Club of the University of Toronto that, while German Government officials and industrial men were aware of the existence of chemists and understood their functions, Britishers occupying similar relative positions were lacking in this knowledge. Both Britain and Germany produced chemists, while Germany alone provided the missing link between the academic chemist and the industrial investor. Naturally, our men of chemical genius remained in obscurity, and the applications of our discoveries were made in enemy lands.

This water has now passed by the mill, and, in a sense, we are starting a new race. There will be competition—friendly with our allies; otherwise with Germany — but, nevertheless, fierce competition. High freight rates will last longer than high ocean shipping rates. All such factors, however, are secondary to the great main truth, that that country will have the industrial edge on its neighbor, where scientific research, chemical or otherwise, is applied to the greatest degree in the development and expansion of natural or acquired resources.

Industrial genius cannot create or sustain united industrial progress. The whole mass of business men

in Canada must become more conscious of the springs from which their power and affluence arise. Carrying on research work pays in the hands of even the average university graduate student. If our business men could be taught to take one small portion of the risk in establishing a laboratory which they will take in some move they feel more capable of understanding, but which may lose them thousands, it would be a big step in advance. We need industrial nerve in this game of research. We need scientific sporting men. That business or industry has a blind eye which does not lay aside each year a sum of money for scientific research in its own line. This is just as necessary as making allowances for plant depreciation and similar losses. Standing still always meant going behind. As a business man, get a grip on the idea that you owe a debt to the basic principles of chemistry and science that made you possible, or you will most certainly fall down with that era that is fast becoming ancient history. There is a day coming when your money will not buy the invention you grasped from the hands of the commercial babe, who was a scientific and economic giant compared with you. Your generation has been but a miner of natural resources, but your future depends on how you mould yourself and your business to fit in with the era you are entering. Organization, amalgamation, trusts, tariffs and advertising will avail nothing unless the cycle is completed by continued scientific and applied chemical and industrial research. There must be an appreciative and sympathetic linking established between industrialists and that army of research men who alone can sustain them now. If they will not come to the chemist, the chemist must go to them. How may this be done? To a limited extent, through conversation and public gatherings. Some every-day chemistry is surely more worthy of discussion than a synopsis of what is taking place on "The Twentieth Plane" of some insane psychologist's nervous system.

But there remains yet the strongest weapon—the public press. If you will glance through the files of some of our leading daily journals previous to 1914, you will find the words "chemistry" and "research" foreign to most of the newswriters of those days. Now, however, real space is being devoted to scraps of information along these lines, and we take it that the demand may still be cultivated. The public will read about the applications of industrial chemistry, if chemists will only tell their story well. The problem reduces itself, then, to a type of legitimate advertising. Some organization—whether it be a publicity branch of the Department of Trade and Commerce, or the Society of Chemical Industry, or a new organization of Canadian chemists—should bring home to the public of Canada some sustained popular presentation of the possibilities of chemistry, as applied to Canadian industries. This needs live men who are not afraid at times to talk powerfully, even to agitate in a cause that must eventually prevail.

For this issue we have obtained two articles, specially designed for presentation to the general public. Mr. S. J. Cook, in a short article, under the head of "Wanted—A Chemical Public," and Mr. A. Burton, on "Coal Tar as a Key Industry," have presented types of what would be read with profit by a large number of thinking business men. We need more chemists and engineers willing to devote some of their energies to such work. Our educational system may not have produced a generation intelligently appreciative of such matters, but we should see to it that this state of affairs is promptly corrected by all means within our power. We need not hesitate. Our Canadian press would meet our chemists half way in this matter.

THE CHEMICAL TARIFF SITUATION.

AS far as we are concerned here in Canada, our authorities have contented themselves with the making and unmaking of certain trade restrictions designed to direct chemicals and raw products into trade channels where they would best accomplish our own war aims and those of our allies. There has been no Government announcement of any arrangements being made to stimulate the growth of special chemical industries in Canada beyond the duration of the war. Certain ores have been produced in increased quantities, and their future depends on existing tariff laws and the initiative of individuals. Now, this is not the case with our neighbors to the south. At the request of the textile trades, a most thorough investigation has been made of the dye situation in the United States. Every encouragement is being given the American manufacturer of certain organic lines. A special report has been made to Congress on dyes and other coal-tar chemicals. More concise and stringent amendments are suggested for the original 1916 Act covering these chemicals. The American Government is gathering a wealth of data through special Commissions appointed to investigate the various chemical industries. Inorganic chemicals will form the subjects of future reports. The whole spirit of the Convention of Chemical Engineers held at Chicago in January was "Protection." The American manufacturer is by no means sure of his ground, and fears European competition all down the line, in chemical and certain metallurgical industries. On the whole, it would appear that Europe is more than likely to remain master of the world's finer chemical markets, unless unprecedented Government action is taken in the United States.

RECENT RESEARCH APPOINTMENTS.

THE Honorary Advisory Council for Scientific and Industrial Research has made plans for establishing three active fellowships and five studentships this year. The recipients are to work in vastly different fields. A "mosquito survey" is to be made in the lower Fraser River by Eric Hearle, under the direction of Dr. Gordon Hewitt, Dominion entomologist. One fellowship and one studentship go to the rubber industries. Coal distillation is also receiving attention, and work will be advanced in connection with methods for using the tar sands of Alberta. Agriculture has not been entirely forgotten, and Miss N. Newton, of Macdonald College, will undertake a study of rust-resisting varieties of wheat. Miss E. Shanley, of McGill, undertakes work on the bacteriology of canned fish. Studies in the production of hydrogen peroxide are also to be made by L. B. Hatcher at McGill University.

It has been repeatedly claimed that the problems awaiting investigation are many, and that the qualified workers are few. There can remain no question about the multitude of problems, and while qualified workers may be few, it is scarcely conceivable that there are only eight students in the whole world of Canadian industrial science who are able to measure up to the research ability of those who have recently been appointed. The aim of these industrial research appointments seems more remote than immediate. It is noteworthy that some large Canadian universities have not a single industrial research worker in either their chemical or metallurgical departments. The movement, however, is important, and we trust further appointments may be forthcoming in the near future.

THE CANADIAN AIRPLANE INDUSTRY.

WHEN the British Empire came to grips with Germany, one of the remarkable achievements of Canada in the war industries was the erection of two fully equipped airplane factories, employing about 3,000 hands in assembling and finishing, and about an equal number in the manufacture of engines and parts contributed from outside factories. Flying machines to the number of 2,300 were built in Toronto and put into service in Canada, and these machines contributed their full share to the victories won by the British air men in France, Belgium, the Balkans, Palestine, Serbia and Mesopotamia.

Now that the war is over the aviation experts are fully convinced that the machines that have accomplished such wonderful things in war can be immediately switched over to the transportation of peace. Indeed, it is certain, not only that the airplane and dirigible air machine can be put into everyday use, but the large airplane works are actually busy converting the military machines into machines for commercial service. More especially is this the case with the large machine used for bombing and air raids, which types only require minor alterations to adapt them to passenger service; and without doubt air machines will be crossing the Atlantic Ocean and making flights across Asia and to Australia before the end of the present year. The United States has already established a flying postal service which has come to stay and grow as certainly as the rural mail delivery service. And what the United States does in its civil administration and transportation systems to-day, Canada must do to-morrow, if not this afternoon. Great Britain, France and Italy, not to speak of Germany, are also committed to a policy of air transportation, and are converting certain types of war machines to peace service.

Such authorities as F. Handley-Page, Caproni and others have staked their reputations on the success of air machines for commercial work, and the vast factories established for these machines and their parts are humming with preparations for the flying age.

With these facts before us, it will seem incredible that the two factories in Toronto are being dismantled and the 3,000 hands already discharged to swell the ranks of the unemployed. The national resources and public funds were used to create these works, to gain the victories of war. Why are not the same resources used to gain in this way the greater victories of peace? If the timidity of private capital is given as a reason for abandoning these works, so much stronger is the reason that the government, which went into this industry for war aims, should maintain it for peace aims, seeing that the government will be its own chief customer in supplying machines for the people's postal service.

It is no argument against the airplane works to say that mail can be delivered more cheaply by land carriage, for the saving of time outweighs the small item of cost for the individual service. This is proved by the history of the automobile. Everybody knows that the street car is a cheaper means of transport per passenger-mile than the auto, but the building of autos is of faster growth than the building of new street cars, or horse vehicles.

If the Honorary Advisory Council has urged the government to continue into the peace era the making of Canadian airplanes, it is not known to the public. If they have, the government has failed in the opportunity it had of reaping the benefits of the council it created. Even yet, if the Advisory Council and the government come together on a plan to restore these plants and get the skilled hands back to work, they will not only take an important step to mitigate the industrial difficulties and the unemployment which lead to social unrest, but they will keep Canada in the front ranks of industrial science and in-

cidentally keep hundreds of chemists and metallurgists at work who will otherwise have to seek employment and opportunity abroad. There are also 3,000 trained Canadian aviators who are qualified to carry on with the machines.

The airplane is the most effective vehicle ever imagined for forest patrol and fire prevention, and the saving of a single forest area from destruction by fire would pay for the equipment of the projected Research Institute and half a dozen airplane factories in addition.

While some of our government officials and some of the numerous commissions are talking in vague generalities of plans of reconstruction, they will surely not allow the organization of this new instrument of modern civilization to drop from nerveless hands, leaving Canada out of the race in industrial science. To do so will be to drop the substance in chasing the shadow.

BUREAUX OF TECHNICAL INFORMATION.

BUSINESS and technical men in Montreal are seriously working on the question of establishing a Bureau of Technical and Commercial Information for that city. The Executive of the Montreal Board of Trade are supporting the movement strongly. Mr. Arthur Surveyor is chairman of a committee appointed to look into the whole matter, bringing together the Board of Trade and the Manufacturers' Association.

Some time ago Sir George Foster had planned, and about completed, the organization of an Industrial Museum to be combined with a National Bureau of Technical and Commercial Information. This, however, has not yet materialized. So far, those who might naturally be interested in such a movement in Toronto have taken no action. Undoubtedly the habit of using such a bureau might be made a valuable asset to many manufacturers. Around such a nucleus could be built up a very practical organization, and one capable of doing good service in many fields. We have many valuable sources of technical information in Dominion and Provincial Government Departments, Universities and Society Libraries. These are not used as much as they might be, and our manufacturers show a striking ignorance either of their existence or importance. Much money and labor would very often be saved by a more thorough investigation of the printed literature already available.

Some organizations detail one or more men to the task of reading all the technical literature published relating to their work in any way. Research invariably involves reading articles written in many languages, and the establishing of bureaux of available information, with capable directing heads, would certainly be a great benefit to those who used them. May we not suggest that the Boards of Trade and manufacturers in both Toronto and Montreal give movements of this nature their heartiest support?

THE Canadian War Trade Mission rendered important service to the trade between this country and the United States during the last two years of the war, and in no department of commercial intercourse was this more appreciated than in the chemical, metal and allied interests which had suffered from the endless and unaccountable restrictions of wartime. It is a logical step to continue into the peace era a system of direct commercial relationship which has proved its great advantages, and the old system of referring everything back to London will no doubt be sloughed off, like last year's snake-skin. In every matter of economic interest the people of Canada and the United States understand their requirements better than anyone else, for they are the communities most concerned. They can adjust their differences more quickly and with a more intimate knowledge of their mutual needs. Most Canadians who have studied the treaties affecting Canada's relations with the United States, from the Ashburton Treaty down to the Alaskan Boundary dispute, think that even in the political field, Canada could have done better by direct negotiations.

NEW YORK LETTER.

Special Correspondence to the Canadian Chemical Journal.

At a meeting of the Council of the American Chemical Society held at the Chemists' Club, New York, December 14, 1918, it was decided to appoint a committee to act in co-operation with the Society for the Promotion of Engineering Education with regard to the training of the chemical engineers.

A committee was also appointed to co-operate with the National Research Council as to the better co-ordination of research throughout the country. Another committee was appointed to deal with the publication of scientific literature. This committee was to co-operate with British and other foreign organizations regarding the compilation and publication in English of reference works on chemistry.

These committees are to report at the spring meeting of the Society. The committees deal with problems that are very important to American chemists just now, and their reports will be awaited with interest.

Other matters dealt with at this meeting were the introduction of the metric system, the importation of scientific material for educational institutions free of duty, etc.

Mr. John Walker Harrington, a journalist of great experience, was appointed to take charge of the work of presenting chemistry in a popular manner in the public press. This is part of an extensive campaign of publicity the Society is carrying on with a view to getting the public to understand better the work of the chemist and the national importance of chemical industries.

A great many other subjects were discussed—in fact all the various problems brought up by the period of reconstruction through which the country is passing were taken up one by one.

The attendance was very large and the number of suggestions sent in from local sections was very large, necessitating many matters being left over for future meetings. Following the long meeting, Dr. Wm. H. Nichols entertained the members of the council to dinner at the Chemists' Club.

On the evening of Friday, January 17, the Perkin Medal for distinguished services to industrial chemistry was awarded to Dr. F. G. Cottrell, the inventor of the Cottrell process of electrical precipitation for fumes and smoke, by the Society of Chemical Industry. There was a large gathering of chemists and engineers to witness the presentation. The meeting was preceded by an informal dinner at the Chemists' Club. Dr. Cottrell is at present Chief Metallurgist of the U. S. Bureau of Mines. He is a Californian by birth, having been born in Oakland, in 1877. He graduated from the University of California, with the degree of B. S., in 1896 and afterwards studied abroad, receiving the degree of Ph.D. from Leipzig, in 1902. Prior to joining the Bureau of Mines he was a member of the faculty of the University of California. The Cottrell process and equipment is offered to the industrial public through the Research Corporation, New York, who has a large number of installations in most successful operation.

January 22, 23 and 24, the Chemical Alliance meets at the Hotel Biltmore, New York, to discuss various matters of interest to the chemical and fertilizer trades.

The Dry Color industry of the United States has organized, forming the Institute of Dry Color Manufacturers, which includes the leading dry color manufacturers in the country. P. S. Tilden of the Harrison Works of I. E. Dupont de Nemours & Co., has been elected President; E. Kohnstamm, of H. Kohnstamm & Co., Vice-President; Marcus Marks, of Morris Hermann & Co., Secretary. The purpose of the institute is to promote the general good of the dry color industry, encourage a spirit of co-operation and co-operate with the Federal Trade Commission, etc. The institute will also take up the standardization of methods of competition.

Dennis J. Dever, manager of the New York office of E. B. Badger & Sons Co., Boston, Mass., died at the Chemists' Club, New York, as the result of an attack of influenza lasting only a few days. Those who only knew Mr. Dever through business dealings with his firm will regret his loss, for all who came in contact with him found him efficient, industrious and courteous. Members of the Chemists Club and others who were personally acquainted with him feel even more keenly the loss of his wonderfully ingratiating personality, which made him one of the most popular members of the Club. Mr. Dever was a native of Vermont, but prior to coming to New York had lived in Boston, Mass. He was connected with E. B. Badger & Sons Co., from the inception of his business career.

Mr. D. D. Berolzheimer, formerly Librarian of the Barrett Company, has accepted the position of Assistant Technical Editor on the staff of the Chemical Catalog Company, Inc., New York. Mr. John Helfrich, who has been in charge of the laboratory of Donald R. Staddon & Co., New York during the absence of Mr. Staddon in the service of the U. S. Government, has also accepted a position with the Chemical Catalog Company, Inc., and is in charge of the Information Bureau.

A great deal of interest is being taken by large concerns in the chemical industry in the possibilities offered by the Webb Bill for export trade combinations. Several of the large banks and trust companies are interesting themselves in the movement and very important results may be looked for. The following remarks which appeared in one of the New York daily papers recently are of interest in this connection:—"Because of the wide variety of the products of chemical industry and the diversity of their uses, it is not held to be practicable to organize the trade as a whole. The present plans, therefore, call for the formation of the combinations by concerns interested in closely related lines, following as nearly as possible the natural divisions of the industry. Thus it is contemplated that one combination should include producers of pharmaceutical goods, another producers of coal tar products, a third manufacturers of agricultural and industrial chemicals, etc.

The advantages of export combinations have been recognized quite generally in the trade for some time past, but it is not until lately that a definite movement has made its appearance. Inquiry has shown that a number of companies would be glad to support such a movement, but were not ready to take the initiative, while officials of other concerns have been somewhat dubious as to the possibility of successfully adapting the form of combination authorized by the law to the particular needs of the chemical industries.

Dr. J Merritt Matthews, in response to questions regarding the situation in the dye trade, recently said that the subject of export combinations had come up for discussion among the manufacturers but that the sentiment seemed to be that foreign trade could best be developed through individual effort. The basis of this view, he explained, was that even in the case of standard colors the various companies marketed their product under different brands with some special features and, further, that the sale of dyestuffs included a certain amount of service in addition to the colors themselves. This, it was felt, could best be dispensed through company organizations rather than through an association.

Another condition that is cited in the trade as constituting an obstacle to the development of export combinations is that many of the larger companies in the drug and chemical business already have well-developed foreign sales organizations. It was pointed out yesterday that these companies would probably oppose objections to giving up their organizations in favor of group agencies and could not be counted upon to support the movement.

"In some lines there seems to be a good chance for getting together," said a man in close touch with the situation yesterday. "Take the sulphuric acid makers, producers of zinc sulphate and similar products. Here the product of various companies is substantially the same and export combinations possess obvious advantages." On the other hand consider that class of products whose market is developed principally through endorsement by the medical profession. Half a dozen manufacturers may be making a certain kind of tablet in which, although substantially identical, slight variation in composition occurs that gives a different standing to the various brands. Another case is supplied by tooth powders and pastes; in fact, any of the trade marked specialties would serve. There seems reason to doubt whether an association of manufacturers whose lines are so strongly competitive will prove practicable. At least a considerable prejudice will probably have to be overcome before its organization is accomplished."

These alleged difficulties were called to the attention of Allen Walker, manager of the foreign trade service of the Guarantee Trust Co. He took the position that while on the face they might appear to be obstacles they were not in fact such. It was entirely practicable, he said, to form combinations under the Webb Law in which full provision was made for existing export organizations of individual participating companies. As to the marketing of strictly competitive lines, this could be done through such an association to the same advantage as through individual agencies with the additional advantages in facilities and lower costs which a combination would offer. The combination would send out salesmen to push particular lines, just as individual companies would do, while effecting a saving in the marketing of non-competitive products.

It is believed that obstacles which apparently stand in the way of the organization of drug and chemical export combinations will be cleared up by further investigation of the subject and considerations of the various forms of such associations. In this connection, emphasis is placed upon the disappearance of the bitter rivalry and suspicion of competitors that has characterized business in the past and the growth of a new spirit of co-operation and mutual helpfulness as demonstrated by the success of the numerous trade associations. The war, it is asserted, has tended to increase the co-operation among drug and chemical producers and in other industries.

F. M. TURNER, Jr.

MONTREAL LETTER.

Montreal, Jan. 26th.

In conversation with one of the largest houses in Montreal, your correspondent was informed that business was "frightfully dull," and that there is not likely to be any improvement for a time at least. "We are now going through our worst time. The feeling of uncertainty which buyers have felt for two months is still with us. It may possibly grow worse, but it is only a question of time until the situation rights itself. We find that buyers will not commit themselves and have adopted a hand-to-mouth policy of making purchases. In so far as our firms are concerned there have been no cancellation of orders, but in a number of cases we have been asked for an extension of the time usually required to absorb the goods ordered." When asked if the present situation was foreseen by the trade, the reply was in the affirmative. "We couldn't expect a turn from war to peace without some dislocation of business, it will take some little time for the industries to adjust themselves to a peace basis. Good examples of the adjustment process are furnished by the packing trade and milling industry. Neither of these know where they will "get off at," but no one doubts that they will eventually land on their feet. The chemical industry is one of the best barometers in the whole of our industrial life and its upset condition is more-or-less true of all our industries. I am satisfied however, the position is only temporary and that in a few month's time the most of our worries will be behind us.

Under the caption, "Now is the Time to get a Chemist," the Pulp and Paper Magazine in one of its January issues has the following pertinent remarks to make in regard to the advisability of establishing a Research Department or a Chemical Laboratory.

"Now is the time for pulp and paper mills to get busy on organizing a research department, or at least a chemical laboratory for routine analysis and plant control. There are a number of chemists who have been doing fine work on military problems, looking for openings in commercial life. The pulp and paper industry is an attractive field for a man with aspirations and ambition. The present is a grand opportunity to get some able men. The editor is in touch with a few chemists and engineers who have had experience in the industry, and would be glad to pass their names on to mills who are alive to the need of technical assistance in solving the problems that lie along the road to successful operation under conditions that will soon surround the industry."

An unusually attractive menu was served up to the members of the Technical Section of the Canadian Pulp and Paper Association which was held here on the 30th and 31st. inst. The Technical Section was organized six years ago and during that period has done most effective work in putting the industry on a scientific basis. Possibly the pulp and paper industry is better served by its technical men than any other of our great basic industries.

The sympathy of the chemical industry will be extended to Mr. Judson DeCew, whose wife died in January, in New York. Mr. DeCew is head of the well known firm, Process Engineers, Limited, with offices in Montreal and New York. This firm specializes in chemical analyses particularly as they relate to the pulp and paper industry. The firm was recently strengthened by the inclusion of Mr. W. B. Campbell, formerly assistant director of the Forest Products Laboratories, at McGill. Mr. Campbell is head of the Montreal end of the firm's business.

J. C. ROSS.

FURTHER COMMENTS ON GOVERNMENT ASSISTED RESEARCH.

As the director of a laboratory serving the electrochemical and electric furnace industries of Canada, the writer of the following letter has had considerable first-hand experience in dealing with industrial men interested in his particular field. We simply pass along an opinion which will be deemed worthy or unworthy according to the previous experience or general conception of the reader:—

Editor Canadian Chemical Journal:

Some of the comments published in the January Chemical Journal on the proposed Guild Laboratories and Government-aided research have brought out one of the most obvious objections to the plan, viz., that the manufacturer who is far-seeing and can afford to have a research laboratory of his own will not be anxious to join any guild laboratory. He prefers to use his own laboratory as a means of doing better than his competitors.

To look at the matter in that way may be very unethical according to the code of ideal co-operation, but is based on an instinct which seems to be rather deeply seated in human nature.

There is too a feature of industrial research work which is very apt to be overlooked by those who have not had much to do with it and also by some of the academic fraternity who have hazy notions about the commercial value of things. One of the most important elements of industrial research is getting hold of the idea on which you are going to work. In my professional work I find that many clients come with the idea of something they want to do. They have no notion at all how they are going to do it, but they set a high value on the Idea, much higher than on the work involved in carrying out the idea—and if the Idea is a good one they are right. Is a member of the Guild who

gets an Idea likely to turn it over to the Guild research laboratory in view of the instinct referred to above?

If research is to be along purely scientific grounds without thought of any immediate industrial gains then it is doubtful if many manufacturers can be interested or at least, if interested, can be sustained for long.

It, therefore, appears that the guild laboratories are unlikely to advance much beyond a co-operative institution mainly employed in testing materials used by the guild and perhaps for working on a few problems which might be of common value, and in regard to which there was no possibility of developments that would be of special use if privately handled.

There is another aspect of the proposal which appears to be very objectionable—the relation of the government to the proposed laboratories. Like so many other propositions that are appearing everywhere at the present day, these are to be government-aided institutions. Is it conceivable that the governmental aid is to be extended without governmental meddling with the aided industries? Is not the proposal merely one example of a wide-spread belief in the beneficence of governmental meddling in all kinds of activities hitherto left to individual initiative?

We have just fnished destroying, at enormous sacrifice, a monstrous development of state control and yet we are apparently so enamoured of its characteritics that in a hundred ways we would imitate its "kultur," from government control of industrial research to governmental prohibition as to the chemical composition of beverages. Are we to be mingled among the heathen and learn their works and serve their idols?

It is a postulate that among free peoples Governments have been instituted for the express purpose of securing certain inalienable rights of the governed; but even the most optimistic will hardly contend that any government has as yet successfully accomplished this task. Yet it is proposed that governments should now enormously increase the sphere of their activities, apparently with the notion that though they have shown incompetence in the limited field hitherto open to them, they will, in some miraculous fashion, be successful with greatly increased duties.

The theory of co-operation, which is at the base of the guild research laboratory is most desirable. Voluntary co-operation is a thing to be preached, in season and out of season, so that we may all strive towards the evolution of that ideal man "whose private requirements coincide with public ones . . . . . who, in spontaneously fulfilling his own nature, incidentally performs the functions of a social unit; yet is only enabled so to fulfil his own nature by all others doing the like." But this ideal can never be reached if co-operation is artificially forced either by governmental coercion or by governmental bribes.

Francis A. J. FitzGerald, Niagara Falls, N.Y.

WESTERN COAL.

By Prof. R. D. McLarin, Saskatoon, Sask.

It has been estimated that Western Canada possesses at least 12 per cent. of the total world's supply of coal and still there is talk of scarcity in the midst of abundance This fact is not generally recognized and in order to visualize the national significance of coal, it is necessary to refer to the development of the coal-tar industry in Germany. Although this industry was developed to a greater extent in its initial stages in England, it was not long before Germany gained control of it and constructed one of the most highly specialized industries in the world.

Synthetic dyes, which are made from coal-tar products, were discovered in England, but the national significance of these compounds was not realized by the British Government, and Germany gained control of this industry to such an extent that for years previous to the outbreak of war, England shipped her crude coal-tar to Germany, and in exchange received the finished dyes. It is doubly noteworthy that the products of coal-tar which are used for making dyes are the same compounds from which explosives are made. Germany made the process of coal distillation the corner stone upon which was reared her economic structure for war, as well as for peace. This poly-headed monster was a more formidable foe than the military machine, which depended on the former for its supplies in metals, explosives, pharmaceuticals, photographic materials, fertilizers and other chemicals. In these materials, Germany acquired the greater part of the world's trade, and thus caused her prospective enemies to be unprepared for war through failure to develop this fundamental national industry.

The possession of ample supplies of coal is essential to national greatness, and the carbonizing experiments which were so successfully conducted at Estevan by Mr. S. M. Darling and which will be elaborated by the Lignite Utilization Board, should be interpreted as an essential step in preparing for future industrial development, rather than the necessity of making briquettes as a substitute for anthracite coal. The making of lignite briquettes for fuel, in view of the enormous supply of bituminous and semi-anthracite coal in Western Canada, has little national significance, apart from the ultimate successful utilization of the by-products, from which innumerable industries will be developed.

The West has always been considered in terms of cereal production, but the time has come for determining how long a permanent system of agriculture can be maintained when that system depends on outside sources of supply for raw materials. The people of the West desire, among other things, duty-free farm implements and fertilizers and one method by which permanent results can be secured in this direction is to develop the raw materials in our own country from which those finished products can be made. As permanent agriculture depends on industrial development of our mineral resources, the time has arrived when further delay may be regretted, and any policy leading towards that end should be carefully considered.

The carbonizing of coal is undoubtedly a step in the right direction, provided it is carried out on the proper basis. According to the report of Mr. R. A. Ross, one immediate object of the carbonizing and briquetting proposal is to produce briquettes from lignite coal with heating value approximating that of anthracite coal. In 1916, Saskatchewan and Manitoba imported 533,000 tons of anthracite from Pennsylvania, and Ontario and Quebec imported 4,037,284 tons of anthracite. Lack of fuel in these two provinces is a serious problem, as the fuel supply comes almost entirely from the United States. If briquettes can be made from lignite to substitute the anthracite imported into the West, then the anthracite now imported into Western Canada can be obtained by Ontario and Quebec, which would increase their supply by one-eighth.

The briquetting plan, as outlined by Mr. R. A. Ross, provides for an expenditure in plant and equipment, etc., of $400,000 for the annual production of 30,000 tons of briquetting. On this basis, it would require over seven

million dollars in plant and capital charges to produce 533,000 tons of briquettes to replace the anthracite imported. Of course, with increased production, the cost of briquettes should be materially reduced. However, if the object of making briquettes in Saskatchewan is to relieve the shortage in Ontario, it will probably be some considerable time before the effect will be appreciably noticed, if briquettes cannot be manufactured at a price much less than $7.00 per ton.

According to the Research Council's proposal, the carbonizing and briquetting plant is to be situated at or near a central railway point in Southern Saskatchewan, for example, Estevan. The location is rather indefinitely stated and furthermore, no particular reasons are given for placing the plant at the indefinite location referred to. No doubt, there are very good reasons for placing the plant at, for example, Estevan, but what advantages would such location have over Regina or Moose Jaw? As the economic success of the project will be determined to a considerable extent by the location of the plant, the writer is of the opinion that the reasons for locating the plant at any point, for example, Estevan, in preference to Regina or Moose Jaw, should be made public.

Carbonizing is undoubtedly the most economical method of treating coals with high volatile content, providing economic conditions are favorable for utilizing the by-products, but if these are wasted, the cost of the carbonized residue and the briquettes must necessarily be high. The time may come when lignite briquettes will compete successfully with Alberta coal, but when that time arrives, the manufacturing cost will be much less than $7.00 per ton. Too much must not be expected from briquetting in the initial stages of the experiment as a source of fuel, for the present conditions are unfavorable, but the time should come in Canada when lignites will be carbonized for the purpose of obtaining the by-products primarily, and the resulting carbonized residue will be of secondary importance. From this point of view, an expenditure of money in research is not only justifiable, but imperative.

(To be continued.)

WANTED: A CHEMICAL PUBLIC.

By S. J. Cook.

Mr. Average Consumer, before the war, took everything that came to him much as a matter of course. He accepted the war when it came much in the same way. But when his requests for certain ordinary essentials were refused with the curt reply that they were not obtainable on account of the war he was amazed to find to what an extent he had been dependent upon European producers and manufacturers to supply his daily needs. He awaited the end of the war. As he waited, however, his patience became exhausted and the idea kept occurring to him: "Why do we not make these things ourselves?" The longer he thought of these things, the more convinced he became that we should produce many finished articles for which we had previously only supplied raw materials. His interest in the chemical world began to grow. Manufacturers, seeing this, began to look for chemists and as a result of the war, there has grown a more intelligent appreciation of who a chemist is, and what he may do when his work is backed up by a real public interest.

Now that the war is over this interest must be sustained and directed in order that Canadian chemical interests may not lose the advantage they have gained. The newspapers and magazines have done well so far; they must do more.

There is a well-defined sentiment abroad in the land which finds expression in the words: "We shall not use German made goods; we shall now buy American products for the people of the United States are producing many articles formerly made in Germany alone, and the quality is just as good, often better. This is true; but this is Canada. We should not lose sight of the fact that in many things we too lead. The public generally does not know much about our chemical work because it has been insufficiently advertised.

A few examples may bring home some facts not as well known as they deserve to be.

The synthesis of acetone from calcium carbide at Shawinigan Falls and the fermentation of starch paste with the formation of butyl alcohol and acetone in the Gooderham works in Toronto are two outstanding war-time Canadian chemical developments. The butyl alcohol referred to has been converted by a process, discovered in Toronto, by which methyl ethyl ketone, a solvent admost equal to acetone, is made.

Since the war began, many rare chemicals formerly purchased abroad for use in this country have been produced successfully and in commercial quantities in our own land. Some of these are salvarsan, salol, acetanilide, phenacetin, salicylic acid, and acetyl salicylic acid, or as it is better known, aspirin.

Indeed, perhaps few know that in the matter of arsenical medicinals, Canada was in a position to supply, and did supply the needs of the United States Army.

Great improvements have been made in Canada in connection with the manufacture of trinitrotoluene as a result of researches carried on at McGill University. Gasoline production here has been increased by the utilization of hitherto unused methods. In metallurgy much progress has been made in the working of various ores which had not been previously used. In organic chemistry, the preparation of molasses and ethyl alcohol from wood waste seems assured, and it is estimated that the waste liquor from three large pulp and paper mills on the St. Lawrence alone could be converted into some 40,000 barrels per annum of ethyl alcohol.

Shawinigan Falls is a treasure store because of its developed and undeveloped power. Nearly half a million horsepower is already being used. The manufacture of carbide, carbon electrodes, aluminum, aloxite, pulp, paper, asbestos, are carried on there. In addition magnesium of above 99 per cent. purity is made from its fused salts; this also for the first time in Canada. Acetic acid, acetic anhydride, paraldehyde, have all become household words associated with Shawinigan Power.

This is only one of the electrochemical developments. Niagara Falls has been longer known and corundum, carborundum, and cyanamide are more words the Canadian has learned from his own industries.

Only the surface has been scratched. What we need is optimism and a public appreciation.

It is said it was a chemists' war. We won that. Let us tackle the chemists' peace and hold what we have gained as a foundation on which to build up many more successful chemical industries in Canada.

PEAT BOGS IN MANITOBA.

The Mines Branch, Department of Mines, Ottawa, has investigated eighteeen peat bogs in Manitoba, and reports that there are bogs in the Winnipeg River district containing 1,860,000 tons of peat fuel, 25 per cent. moisture.

Concrete as a Chemical Engineering Material*

By Maximilian Toch

IT may truly be said that this is the age of concrete. What progress would our new factories have made, after this country went into the war, when steel and iron were unobtainable, had it not been for the ability to use Portland cement in their place? It is no criticism to say that Portland-cement concrete is an unfinished material, when used in the erection of chemical works. No floor in any factory will last very long made of Portland cement and sand, unless it is treated in some manner. I have seen instances where the concrete foundations of vinegar tanks were decomposed until they resembled a material like cheese, owing to the solvent action of acetic acid. I have seen foundations of motors and machinery, where the oil drippings disintegrated concrete in a relatively short period. I could cite many more cases, but these will suffice. There are a great many materials which preserve Portland-cement construction against acids, alkalis, oils and saline solutions, and there is no one material which may be regarded as a panacea for all the defects of concrete. When the defects of concrete are mentioned, I must again impress upon you that I am not criticizing the material; but a concrete sidewalk is about the only cement construction of any magnitude that I can recall which needs no treatment to make it waterproof, wearproof and weatherproof. Take the case of a concrete floor in a room where there is delicate machinery. In a short time the particles of sand and broken stone, which form the composite of the concrete, become loosened, float around in the air and lodge on the contact points of this delicate machinery. Take the case of foundations in chemical works, where acids and alkalis drip on the foundations. Take the case of concrete foundations of factory buildings on a water-front, where nitre cake and sludge acids are discharged in the stream, and you will soon erode the concrete foundations. All this is due to a very simple chemical problem. Portland cement has been described so often that I do not need to go into its chemical composition, other than to say that, when it is mixed with water, it generates lime, and the lime forms a glutinant material, which binds the particles together. This same condition is identical in all mortars, and the common, ordinary lime mortar of building material, while it contains a much greater amount of lime than Portland cement, is weaker in every respect to that of Portland cement itself. Lime is slightly soluble in plain water and is relatively more soluble in salt water. This accounts for the disintegration of Portland cement at the sea shore. Any acid, no matter how weak, forms a chemical combination with lime, and when the lime is attacked in Portland cement, the structure itself crumbles. There are a large number of methods used for the protection and preservation of Portland cement; and, as I have said before, there is no single method applicable in every case. Our Government, and every other Government, has had an enormous amount of trouble in building dry docks which would withstand sea water, even though some of these dry docks were faced with granite or other building stones, because the building stones must be cemented together with a mortar containing lime in some form. A very interesting case developed in one of the large dry docks in New York Harbor, where the sea walls were waterproofed with an integral material, but where the bottom was not waterproofed, and after a lapse of five years, the solvent action of the salt water attacked the bottom, but left the sides untouched. But the greatest problem of all is the construction of foundations, vats and storage buildings for chemical materials, which should be proof against acids and alkalis under normal conditions. Up to within two years ago, no one ever thought of building storage warehouses of concrete for the storing of large quantities of nitre cake. This material, as you know, is an acid sulphate of sodium containing as high as thirty per cent. of free sulphuric acid, and yet it has been possible to build successfully such a storage building which would house nitre cake and not attack the walls and floors made of concrete. In a case like this, it is necessary to use two methods—one, an integral method, and, in addition to this, a surface coating which will be acid-proof. The great scarcity of boiler plate for the building of large tanks forced our own Government to build tanks for the storage of fuel oil, of concrete; and, as there are two kinds of fuel oil—the very heavy Maltha, of the West coast, and the thinner type of Pennsylvania and Ohio—it soon becomes obvious that the Maltha or Western type could be stored in any kind of a pit made of any material, but the Eastern oil would soon destroy the crystaline structure of Portland cement and leak through. So it became essential to find methods of making concrete oil-proof, and in this, again, the integral, plus the the surface-coating method, are essential.

To use a very homely comparison, and one that is somewhat graphic, I must frankly state that, unless the engineers' specifications are strictly carried out, failure will inevitably result, and no material should be blamed for a lack of supervision. To write a specification for concrete and chemical engineering construction is not an easy matter, and unless the inspector is intelligent and watchful, failure may result. I always think, in this connection, of the case of the man who went into a restaurant and called the waiter, and explained to him the kind of a steak that he wanted. He insisted that the steak should be an inch and a half thick and six or seven inches long, and it should be grilled over a coke fire for forty-five minutes at a distance of one foot from the fire; that, after it was grilled, it should be smothered with mushrooms and onions, and then allowed to seep for ten minutes and placed on a hot plate and served to him. The waiter, after having carefully listened to these orders, walks over to the kitchen and yells "One steak." This is a very fair example of how many specifications are carried out and how engineering materials are blamed for the lack of carrying out the orders carefully.

It is not my purpose to give any specifications for the various types of water-proof and chemical-proof materials now on the market for the preservation of Portland-cement concrete; but, suffice it to say, that there are not very many materials on the market which are completely meritorious, and the negative attitude in times gone by of the Bureau of Standards is, to my mind, largely due to the fact that several materials have been exploited which have been without merit. In fact, unless a man is scientifically trained and knows the re-actions that may take place when various materials are subsequently stored or come in contact with concrete, he cannot devise a material which shall fulfill the purpose, but, fortunately, as these materials are found out and found wanting, they, from time to time, dis-

appear from the market, but in the meantime they harm directly and indirectly those compounds which have shown and proven their efficacy. I have a case in mind where one of the foremost architects in the United States has condemned all materials on account of failures which he has seen made with materials which should not have been used.

The following, in a general way, are the types of waterproofing used in the chemical industries:—

First.—The integral type, which is used in the form of a dry powder, and the action is to densify the concrete, give it colloidal properties and to lubricate the mass while pouring. There are a large number of paste aqueous materials on the market, some of which are a kind of soap. General speaking, these soaps are to be avoided.

Second.—The next type well known is the varnish type, which depends for its re-action on acid resins, and has proven itself water-proof, oil-proof and wear-proof.

Third.—The third type is the fluol-silicate type, which, in conjunction with the acid-resin type or the bituminous-coating type, where a proper bond can be effected, has given most excellent results.

There are, of course, modifications of these types, and I have in mind the building of the first storage building for nitre cake large enough to hold a thousand tons, in which the concrete, after two years, has not shown the slightest disintegration. Another modification of this type is used for the building of concrete foundations along water fronts, where the water is decidedly acid, and it is quite obvious that, unless the concrete is properly treated the solvent action of acid water would erode and dissolve away the concrete in a short time, and yet under proper treatment such foundations have stood up without showing the slightest sign of decay or disintegration, and the manufacturers are all aware of the fact that concrete may be constructed which is proof against acid fumes, and a number of these buildings are all in successful operation.

We must bear in mind that civilization is the great destroyer of our building materials. In the balmy air of Southern Italy, where temperature changes are not very great and where the people still burn wood, and very little of that, and that only for domestic purposes, the masonry construction of the Roman Aqueduct has stood for two thousand years without disintegration. The same is true of the masonry construction of Egypt, yet we know that our obelisk, after having stood for twenty centuries in Egypt, began to disintegrate after it was erected in Central Park in New York, due, first, to the climatic changes, and, secondly, to the sulphuric acid in the air. I had occasion to examine most minutely the Tomb of Perneb after it arrived and was set up at the Metropolitan Museum of Art in New York. This tomb was built forty-five hundred years ago, and the stones were in perfect condition when they arrived, but the atmosphere in New York soon began to produce an excrescence, due entirely to the foreign substances in our atmosphere. The same is true of the monumental buildings of London, where, as long as there were no factories, the great buildings showed no signs of decay, but when London began to burn soft coal and belched sulphurous and sulphuric acid into the air, the building stone and cement construction immediately showed signs of decay and deterioration. This condition is, of course, amplified by the ordinary fumes in a chemical factory itself and it is very fortunate that through modern methods of skilful investigation Portland cement can be made to resist these conditions. Railway engineers are recognizing this all over the country, and where locomotive blasts belch forth their fumes against concrete bridge arches, the arches are treated so that they will withstand the onslaught of chemical vapors.

Briefly summed up, the methods for the protection of concrete against erosion, chemical action, disintegration and decomposition are as follows:—

First.—The well-known membrane method, which consists usually of applying tar, asphalt or other bituminous materials, in conjunction with a membrane such as felt, burlap or textile fabric of any kind.

Second.—The brush application on the exterior of a concrete construction of a hydro-carbon material, which is neutral.

Third.—The brush application of an acid resin which combines with the lime of the concrete and forms an integral material on the surface only.

Fourth.—The addition of a dry powder not to exceed two per cent., to densify concrete and to make it waterproof.

Fifth.—The addition of an integral powder to the concrete, to make it acid and alkali-proof.

Sixth.—The application of a brush coating or spray of a silico-fluoride, which precipitates silica into the interstices or pores of the concrete and makes it proof against oil and water.

Seventh.—Coating the concrete structure with two solutions which interact and precipitate and form an insoluble residue which prevents penetration of chemical compounds.

This, in a general way, is the practice of the present day, and sometimes two or more methods are used where the concrete is subjected to extraordinary conditions, but sufficient work has been done on this subject to enable chemical engineers to state, with a considerable degree of assurance, that concrete, which ten years ago was regarded as unfit as a building material in the chemical industry, can to-day be so manipulated that it has taken its place as one of the best, if not the cheapest, and most enduring material in chemical engineering.

*Address delivered before the American Institute of Chemical Engineers, Chicago, January 16th, 1919.

INCREASE IN PULP AND PAPER EXPORTS.

In a report issued by the Dominion Bureau of Statistics giving a summary of Canadian trade for 1916, 1917 and 1918, it is shown that Canada's exportations of printing paper and wood pulp during the last three years have been steadily increasing. The value of printing paper increased from $20,721,543 in 1916 to $37,190,410 in 1918, while the value of the wood pulp exported has increased from $16,680,984 in 1916 to $32,580,619 in 1918.

COPPERITE: HIGH SPEED ALLOY.

Copperite is a new high speed alloy. It is said to be an alloy of zirconium and nickel. It has a bright silvery lustre and a specific gravity much lower than other alloys used for high-speed work. Copperite contains no carbon or iron, and consequently is not a steel. Its melting point is only about 1150 deg. C., and owing to the fact that the alloy remains in a liquid state for a considerable period before solidifying, difficult castings can be made with ease. No heat treatment is said to be required, the hardness being varied by changing the proportion of the constituents. Cutting tools have been produced with a hardness of 250 up to 500 Brinell, the latter still retaining sufficient toughness to withstand heavy roughing cuts.

THE MANUFACTURE OF SYNTHETIC ACETIC ACID AND OTHER ORGANIC CHEMICALS IN CANADA.

Among the many new industries which have been developed in Canada during the war, none has attracted more interest and attention than the development of the process used by the Canadian Electro Products Co., Limited, at Shawinigan Falls, Que., in the synthetic manufacture of acetic acid.

So much has been written during the past two years regarding this plant and process that most persons interested in acetic and other chemicals are more or less familiar with the details of the process used. However, for the benefit of those who have not as yet had an opportunity of learning the details a brief summary may not be amiss.

View of Plant, Canadian Electro Products Co., Ltd., Shawinigan Falls, Quebec

The process consists of:

1. The conversion of acetylene gas to acetaldehyde in the presence of sulphuric acid and a mercury salt.
   The acetylene gas used in this process is generated at what is probably the largest generating station in the world.
2. The conversion of the acetaldehyde to acetic acid by oxidation in the presence of a catalyzer.
3. The catalytic decomposition of glacial acetic into acetone.

In each process the crude materials are carefully distilled, so that only pure products are used for the next step, i.e., refined acetaldehyde is used for the manufacture of acetic, and glacial or concentrated acetic is used in the final process.

One of the most striking features of this new process is the fact that glacial acetic acid of over 99 per cent. strength is obtained from the stills on first run, thereby assuring quick and economical production.

Annother additional feature is the purity of the crude acid obtained by this process. This crude acid does not contain any of the impurities which are always present in the crude acid made by the wood distillation process. It is absolutely free from sulphuric acid, tar or resinous matter and is absolutely water white in color. This purity of the crude acid is, therefore, a decided advantage in the manufacture of colors, etc., and also when used in dyeing. It has been found by actual experience in several color-manufacturing plants and dye houses that the results obtained by the use of the crude acid made by this process are decidedly superior in many ways to the results obtained by the crude acid previously used. In every case, the colors have been brighter, shades and tints truer and more easily duplicated and that the results in every way have been more uniform. These results, of course, are due to the purer quality of the crude acid and to the absolute uniformity.

Two plants were erected for the manufacture of acetic by this process, each plant having a capacity of approximately 700 to 800 gross tons of glacial acetic per month. One of these plants has been in operation since 1916 and has proved beyond doubt that the process is commercially successful.

A great deal of research and experimental work has been undertaken by the chemists responsible for the development of this process, with a view of developing other synthetic materials. This research work has proved that many other commonly-used organic products can readily be made "synthetically" from the acetylene base and inter-

mediate products made available in the manufacture of acetic. It is quite possible at least some of the following products will be manufactured synthetically in the near future, and that others will be developed from time to time:—

Alcohol,	Dichlorethane,
Acetic Anhydride,	Ethyl Acetate,
Acetylene Tetrachloride,	Formaldehyde,
Chloral Hydrate,	Monochlor Acetic Acid.
Chloroform,	Paraldehyde.

Many of the chemicals mentioned above are now being made synthetically from acetylene in Europe, particularly in Switzerland, France and Germany. While there is no doubt a certain similarity in the different developments in these various countries, those responsible for the Canadian undertaking feel certain that they can meet foreign competition in this field owing to many advantages the process they have patented has over any similar development elsewhere.

The production of synthetic chemicals is a new addition to the industrial life of Canada, and while it is as yet in its infancy, it is expected that this interesting "war baby" will soon develop into one of Canada's industrial giants.

Owing to the favorable location of the plant at Shawinigan Falls, which is the electro-chemical centre in Canada, and to the company's connection with the Shawinigan Water & Power Company, and the Canada Carbide Company, the future supply of raw material is assured, and this industry, therefore, looks forward to the return of normal times with every confidence of success and further expansion.

McArthur, Irwin, Limited, have been appointed distributors to the Canadian trade for acetic acid manufactured by the Canadian Electro Products Co., Ltd.

EXTENSION LECTURES ON APPLIED INDUSTRIAL CHEMISTRY.

McGill University, Montreal, has arranged for a course of lectures to be given during the next three months, on the principles and processes of chemistry as applied to a variety of industries. These lectures will be given by specialists well qualified to deal in a practical way with the subjects discussed and will be delivered on Wednesdays and Fridays at 7:30 p.m. in the chemistry building of McGill University.

The fee for the course is placed at $5. The idea is one which should be taken up in other places. At the present time the public mind is well prepared for the enthusiastic reception of just such information and instruction. A broader conception of the nature of industrial chemistry is one of the needs of the average Canadian business man to-day, and all efforts designed to correct this lack should be heartily supported. An outline of the course follows:

Titles of Lectures	Dates	Names of Lecturers
1. Water, its industrial uses and purification	Jan. 29	C. R. Hazen, M.Sc.
2. Apparatus and machinery used in the chemical industries	" 31	F. M. G. Johnson, Ph.D.
3. Solid fuel, coal, ash, and peats, powdered coal	Feb. 5	Not yet announced
4. Liquid fuel, crude petroleum and its products	" 7	Not yet announced
5. Gas fuel, natural producer	" 12	R. Kennedy, Esq.
6. Coal Gas	" 14	" " "
7. Paints and colours	" 19	G. M. Edwards B. Sc.
8. Varnishes, etc.	" 21	G. M. Edwards B. Sc.
9. Fats and oils, their origin, composition and uses as foods, etc.	" 26	Dr. R. F. Ruttan
10. Leather Tanning	" 28	T. A. Faust, Esq.
11. Dyes and Dyeing	Mar. 5	P. H. Walsh, F. I. E.
12. Sugar (cane and beetroot.)	" 7	C. Bardorf, Esq.
13. Pulp	" 12	J. N. Stephenson, Esq.
14. Paper.	" 14	J. N. Stephenson, Esq
15. Sulphuric and nitric acid		
16. Explosives	" 21	Dr. A. R. M. McLean.
17. Starch, dextrine and glucose	" 26	Dr. R. F. Ruttan.
18. Portland cement	" 28	A. C. Taggs, Esq.
19. Glass.	Apr. 2	Percy Cole, M. Sc.
20. Fertilizers and glue.	" 4	Percy Cole, M. Sc.
21. Iron.	" 9	W. G. Dauncey, Esq.
22. Steel	" 11	W. G. Daucey, Esq.
23. Electro metallurgy.	" 16	Dr. A. Stansfield. (
24. Lead and its alloys.	" 18	H. Roast, Esq.
25. Ethyl alcohol and its products	" 23	H. G. Schuck, Esq.
26. Distillation of wood and its products	" 25	C. R. Hazen, M. Sc.

PETROLEUM IN WESTERN PROVINCES.

M. James White, F.R.C.S., M.E.I.C., Assistant to the Chairman, Deputy Head of the Commission of Conservation of Canada, has recently issued a booklet entitled: "Fuels of Western Canada." The fact that oil has been found in the Pelican Rapids gas well, and a small quantity in one of the wells in the Viking gas field, is in Mr. White's opinion justification for the hope that petroleum will be found in considerable quantities in the Peace and Athabasca valleys. Seepages of oil have been found near Waterton lake in southwestern Alberta, and in the Flathead valley in southeastern British Columbia, while enormous tar seepages in northern Alberta, extending a distance of over 100 miles along the Athabasca River, indicate an upwelling of petroleum unequalled elsewhere in the world. Mr. White states that near Peace River Landing oil has been found in two wells, 900 and 1,100 feet deep respectively. In 1917, 312,000 gallons of gasolene and kerosene were recovered from Alberta crude oils, while the production of crude petroleum in Alberta amounted in the same year to 8,500 barrels. According to the pamphlet, the discovery of large oil fields in Alberta and in Saskatchewan, would retain in Canada $5,000.000 now paid for petroleum and its products.

Coal Tar as a Key Industry

What the Development of a Coal Tar Industry Means in the Economy of a Company, and its Position as a Key Industry

By Alfred Burton, Secretary S. C. I.

WHILST we have not all the necessary materials in Canada for the development of a coal-tar industry, still the raw product is to be found in our coal areas, and it may not tbe amiss to look over the situation, now that we are confronted with the proposition of developing our exports and supplying ourselves with the goods we need from our own raw materials with a view to maintaining our trade balance and thus enabling us to meet the heavy financial burdens imposed by the war.

As, no doubt, many readers of this article are aware, coal-tar is obtained from coal by destructive distillation, and as a by-product in the manufacture of coke for the steel industries and coal gas for illuminating purposes.

In both of these processes, special grades of bituminous coal are heated to a high temperature free from contact with the air, causing a chemical separation or decomposition into tar, ammonia, gas and coke.

With specialized plant equipment, benzol, tuluol, light oils, naptha, cyanides, sulphur, and gas carbon are recovered, leaving tar-pitch as a residue.

The coke manufacturer is mostly interested in the quality of his coke for the purpose of making pig iron, whilst the gas companies are principally concerned in the illuminating power of their gas, which has caused the development of different designs of plant apparatus specifically applicable for the purpose of each, and thus resulting in the production of tars of varying composition, the most important difference being in the proportion of phenol and cresol contained in the distillate, which are present in greater quantity in gas tars than in coke oven tars.

On account of water-gas for illuminating purposes, being used more largely on this continent than in Europe—especially in England—a much larger proportion of gas-tars are available in England than here, thus placing at their disposal a larger amount of phenol, carbolic acid and cresol, causing us to adopt a synthetic method of production of phenol to make up this delinquency.

As the production of tar in Canada is a by-product, its production is not stimulated by the demand for tar itself, but depends upon the requirements of coke for smelting and gas for illumination; thereby the industry is bound up in its future in the development of these industries, which, especially the steel industry, have been greatly stimulated by the war.

A great many chemical compounds have been extracted from tar, amongst which those of the most general commercial value are: benzene, toluene, xylene, cumene, naphthalene, anthracene, phenanthrene, carbazol, phenol, cresol, xylidine, pyridine, quinoline, carbon bisulphide and free carbon.

The most common commercial distillation fractions are mixtures sold under such wide names as solvent naphtha, light oil, dead oil, creosote oil, anthracene oil and pitch.

The latter is used chiefly for road making, (and here let it be remarked that if we are to have a well-developed good roads policy in Canada let it be seen that the pitch used is made in Canada), roofing, tar shingles and tarred felts, building paper, compounding with rubber, sealing dry batteries and as a fuel, also as a binder for briquetting coal dust.

Creosote oil is used for the preservation of wood, telegraph poles, fence posts, railroad ties, and paving blocks.

Solvent naphtha as a solvent for paint, rubber cements, and other materials, as well as in soap manufacture.

Benzene and toluene are the essential raw materials for the production of many coal-tar intermediates, such as aniline and toluidine, many dyes, fine chemicals and pharmaceuticals and medicinal substances, photographic mediums, synthetic flavors and perfumes. They are also most important in the manufacture of high explosives, the most satisfactory shell filler being trinitrotoluene, or T. N. T. Other fillers are picric acid, ammonium picrate, and ammonium nitrate. T. N. T. is made from toluene, and picric acid and ammonium picrate from benzene. Toluene is also of importance in the manufacture of preservatives, such as benzoic acid, sodium benzoate, and saccharin.

The unrectified crudes, benzol and toluol, are of use as substitutes for turpentine, as a paint remover, and as a solvent for many organic substances, and can be used as a substitute for gasoline as a motor fuel.

The chief source of benzol and toluol is the by-product coke oven; from gas tars they were obtained by "shipping" the gas. Small amounts have been obtained from dehydrogenation of petroleum oils, the oil being "cracked" with gasoline, benzol, toluol, etc. During the period of the war, all these processes were utilized to their utmost extent, owing to the need of these materials for explosives. When the military need disappears, the production will be on a basis far in excess of the demand for the manufacture of coal-tar colors and synthetic chemicals. Benzol and toluol can, however, be unified with gasoline for fuel, and as this continent is the largest producer of gasoline and we should have the lowest price of any country, therefore it should also have the lowest price for benzol and toluol; which means that the coal-tar industry will have sufficient supplies of the essential raw materials at a price as low or lower than that of any other continent.

The other crudes, anthracene, cresol, naphthalene, etc., are all useful as raw materials in the production of intermediates, whilst some of them in the refined state are used as finished products, therefore they play a double role.

In the manufacture of coal-tar products, there is quite a diversity of other chemicals needed, which includes such acids as sulphuric, nitric, hydrochloric, acetic, oxalic, and gallic, the alkalis, caustic soda and potash, soda ash, lime, sodium chloride, sulphide, chromate, nitrate, ammonia, bromine, naptha and ethyl alcohol, formaldehyde, phosgene, zinc dust and scrap iron. All of these materials are obtainable on this continent, and will be available in ample supply and at advantageous prices, so that as far as this continent is concerned supplies and prices of raw materials will be available under as favorable conditions for the development and maintenance of a coal-tar industry, as in any other country.

The intimate connection between coal-tar colors and explosives is most important from a military standpoint, owing to the fact that a factory making coal-tar colors can readily be converted to the production of the materials used in the manufacture of explosives. As an example, take the manufacture of sulphur black, the color having the largest sale of any one color to-day, and picric acid, so

important as a high explosive for filling shells, where the process of manufacture is identical up to the last stage. A plant being in operation with the entire process for the production of picric acid except the last stage can, therefore, very readily be equipped for the final process at a small additional outlay with the maximum speed, or the equipment may even be on hand ready for utilization in an emergency. It is well known that the Germans thoroughly understood these facts and were prepared accordingly.

A similar relationship exists between trinitrotoluene and several coal-tar colors derived from toluene, which is sufficient to be of great military importance. Tetranitroaniline, tetranitro-methylaniline and the nitrocresols are also materials of military value in the production of explosives.

Diphenylamine, though not an explosive, is vital for use as a stabilizer in smokeless powders, whilst it is also of importance as an intermediate in the production of coal-tar colors.

A country, therefore, having a well-developed coal-tar industry can readily go on a war footing, while nations which lack such an industry will experience great difficulty and delay in successfully meeting military requirements, if, indeed, they are able at all to cope with the situation.

Even the other branches of the explosive industry—the manufacture of gun-cotton, fulminates and dynamite, do not occupy so close an analogy to the coal-tar industry as does the manufacture of high explosives.

Synthetic drugs are dependent upon the coal tar industry, a similar relation existing with the manufacture of flavors, perfumes, photographic materials and color lakes.

A well-developed coal-tar industry acts as a key industry around which these other manufactures would branch out and be a means of making use of by-products made in producing intermediates required in the coal-tar color works.

The manufacture of synthetic phenolic resins and synthetic tanning materials, which are made chiefly from phenol and formaldehyde, furnish a means of maintaining in peace times an industry that will utilize phenol, so vital to the manufacture of explosives in war time.

It is obvious, therefore, that the creation and maintenance of such a key industry is vital in supplying an organization and administrative machinery that can be of use in times of war or peace, and as the raw materials are to hand it is a means towards developing our own raw materials and providing an opportunity of entering the export field, and as coal is more abundant on this continent there is no doubt that the industry will hold its own against European competition in the future. Cannot, then, the powers that be give this industry proper recognition? As the struggle that is just now over was in many of its phases a war of chemical industry, so it will prove to be in the competition of trade and commerce.

PRODUCTION OF OTTAWA MINT FOR 1918.

Canadian coins to the value of $3,170,221 were issued by the Ottawa branch of the Royal Mint during the year just closed. Coins to the value of $245,000, for Newfoundland, comprising 620,000 silver pieces were also issued. The total number of Canadian pieces coined during 1918 was 30,904,468, and the total number of coins of all kinds was 32,167,429. During the year 4,435,200 shilling blanks were produced and shipped to the Royal Mint at London.

BIOCHEMISTRY IN LIFE AND INDUSTRY.

Prof. T. Brailsford Robertson, of the University of Toronto, spoke before the Royal Canadian Institute on January 11. The relations existing between biochemistry and modern industry are becoming more important every day. The war has taught us lessons along these lines and it is anticipated that some of the most far reaching discoveries yet made by science will come from these fields. During the course of his address Prof. Robertson brought out many points of great interest to the average reader. Both in practice and theory our biochemists have been very progressive.

The efficient use of pure and applied science in relation to industries and public affairs which has been made by our opponents has very greatly contributed to their power and prosperity, and if we are to compete successfully with them in the future era of excessive competition, we must learn to be equally expert in utilizing the results of scientific research and equally industrious in discovering new facts and principals. We must learn and the public must learn to appreciate the nature of the part which is played by the different sciences in affecting human welfare.

Biochemistry is the science of chemistry applied to living animals and plants and to their products. At first sight this subject might seem to have little bearing upon the daily affairs of man, but in reality Biochemistry has been very useful to our opponents in this war, and lately we too have begun to see the importance of this type of knowledge in many unexpected fields.

Plant and animal products are now used very widely in the industries and a great field is opening up for the discovery of new uses for the various products of animal and plant life. At present, besides foodstuffs, textiles and leather, adhesives, sizes, waterproofing materials, substitutes for ivory and celluloid, photographic and moving picture films, solvents for explosives, constituents of paints, varnishes, waxes and acids are all being produced from the tissues or products of animals or plants. We are only at the beginning of the future possibilities in this direction.

Biochemistry has also an important relationship to agriculture and particularly to the questions arising out of the feeding of stock. In times of food shortage like the present the movements of food products should be guided by accurate knowledge of Biochemical principles.

Biochemitsry has an even more important relationship to medicine. The diagnosis and treatment of many diseases such as Bright's Disease and Diabetes are dependent upon information gained by chemical analysis of the blood and excreta. In the problems of nutrition and growth, and of Cancer and other diseases arising out of abnormal behaviour of the tissues Biochemistry is playing a part and an increasingly important part in our advance towards a solution and the more perfect understanding which will ultimately give us the key to prevention or cure.

GETS POSTHUMOUS HONOUR.

Major James G. Burns, officer in command of 32nd Battery overseas, and who was killed September 28th, at Cambrai, was awarded posthumously the D.S.O. This word has been received by his father, Rev. R. N. Burns, acting general superintendent of the Methodist Church.

Major Burns was a graduate in chemistry and mineralogy from the University of Toronto, 1914.

The Standardization of Thermometers

By P. V. Rosewarne and Garnet P. Ham

THE scope of this article is not intended to include such delicate physical determinations as are carried out in determining the fundamental intervals or points of a primary standard thermometer, but to give in convenient form a few facts for the determination of the larger errors of mercurial thermometers used in industrial laboratory work. The facts so set down have been tested out in actual laboratory practice and have been accumulated from various sources which will be, as far as possible, indicated by specific reference.

A good laboratory thermometer should, according to U. S. Bureau of Standards, be made of Borosilicate, normal hard French or English crystal glass; the Borosilicate glass being used for the higher temperatures, i.e., between 450 and 550 degrees Centigrade. The stem should be straight having a circular cross-section of about 6 mm. in diameter and may have an enamelled back. It may also be of softer glass than the bulb, providing that the maximum temperature attained does not exceed 450 degrees Centigrade. The capillary bore should also be circular in cross-section and not less than 0.1 mm. in diameter, and the variation of the area of cross-section should not exceed 4% under any circumstances. The graduation marks should preferably be etched on the stem and be fine and clear cut; neither should the marks extend closer than 2 centimeters to the top of the bulb. A thermometer having an enclosed paper scale is not satisfactory and this applies also to one having an enclosed milk-glass scale, unless great care is taken in the manufacture to prevent the plate slipping out of position. A safety reservoir should be blown at the top of the capillary to prevent breakage in case of accidental overheating. The mercury bulb at the bottom should not have a greater diameter than the stem, there should be no ridges or indentations and the whole appearance should show evidence of careful workmanship.

Before being put into use, thermometers should be compared with standards and corrections established. The general practice is to immerse a thermometer of known standard into a temperature bath and at the same time immerse the thermometer to be tested. By comparing the readings of both thermometers, a correction may be obtained for the one under examination providing that several determining factors are taken into account; these being depth of immersion of both thermometers, exposed stem allowance, lag of thermometers and uniformity of temperature bath.

The depth of immersion may be taken as three inches and the proper correction applied for the length of mercury column extending above the surface of the bath, this factor is discussed under emergent stem corrections. It is of course understood, that the mercury column of a thermometer does not immediately indicate the true temperature of the bath, but lags behind or follows it at a longer or shorter distance, dependent on the thermometer bulb dimensions, the kind of glass used in manufacturing the thermometer, the medium used in the immersion bath and assuming uniformity of temperature throughout the bath. This characteristic is known as the lag of thermometers.

Comparsion of Instruments Above Normal Temperatures.

The apparatus required to rig up a simple thermometer comparator is to be found in any well-supplied industrial laboratory and consists of:

(1.) A primary standard thermometer. (A standard instrument possessing a certificate of corrections from a reliable source.)
(2.) Large beaker of about one litre capacity.
(3.) An electric hot plate.
(4.) Motor and glass stirrer.
(5.) Clamp and stand.

Set-Up of Apparatus.

Cover the surface of the hot plate with a piece of sheet asbestos. Fill the beaker to within one inch of brim with concentrated sulphuric acid. Wrap the exposed portion of the beaker with asbestos and wire in place. Put the standardized thermometer through a one-holed cork and hold in a vertical position in the acid by means of the clamp and stand using the cork between the jaws of the clamp. The thermometer to be tested is fastened in a like manner. Immersion of both thermometers to be an exacting three inches from the bottom of the bulb. Place the stirrer spindle directly behind thermometers, making sure of clearance of both instruments and the walls of the beaker. The stirrer and thermometers when in position should represent approximately the apex points of an equilateral triangle. Motor is then levelled up to proper height, wired and finally connected with spindle pulley by means of an elastic band.

Procedure.

As an example it is required to standardize a thermometer which is to be used in determining the boiling points of ethyl alcohol, i. e., it is to be compared with the standard within a range of 73 to 83 degrees Centigrade.

Switch on motor. By means of a hot plate, bring the temperature of sulphuric bath up to approximately 65 deg., and when at 70 degrees, switch off hot plate and the temperature should gradually rise to almost 73 degrees, due to the specific heat of the hot plate. From this point, by alternate switching on and off of the hot plate for a few minutes at a time, the temperature may be increased at any desired rate.

It will be understood, however, that before readings can be taken, temperature of the immersion bath should be absolutely uniform and that the rise should be gradual and not faster than 0.10 degrees in two minutes; with this rate of increase of temperature the error due to lag will be less than 0.01 degrees.

At 72.80 degrees read the standard by means of glass, note temperature, read second thermometer, note and then read back again to standard, thus:

Standard Thermometer	2nd Thermometer	Differences in Reading Positive	Negative
72.80°	73.10°		−0.30°
72.83	73.10		−0.27
72.92	73.20		−0.27
72.94	73.20		−0.26
73.00	73.28		−0.28
73.02	73.28		−0.26
73.15	73.40		−0.25

Hence the mean differences in readings between the two thermometers is 0.27 degrees in the neighborhood of 73 degrees. This same procedure is carried out for every degree range as far as 83 degrees, the readings beginning a few tenths below and continuing until a few degrees

above the actual graduation mark. The mean difference is obtained each time, noting, however, whether it be positive or negative.

In order to check this work, observations may be made while the immersion bath is cooling, i. e., by means of steady stirring the temperature is lowered. As an instance, the indicated reading is 83 degrees and a reading is desired at 78 degrees. When the temperature is brought to approximately 80 degrees heat is applied and by alternate heating and cooling a gradual reduction of temperature may be obtained. In this manner observations may be taken which should check previous readings at least to within 0.03 degrees.

Summary of Results.

Before making final corrections to thermometer under examination, whatever correction is necessary is made for the standard thermometer, whether it be for bore or exposed stem. Suppose that at 73 degrees range, the mean difference of temperature between both thermometers is −0.27 degrees, but corrections amounting to −0.35 degrees are necessary for the standard at this point. Then this instrument when reading 73.35 is really indicating 73.00 degrees and the true correction to be applied to our thermometer will be the algebraic sum of both corrections.

So for complete range:

Temperature	Mean Differences of Temperature	Standard Thermometer Corrections	Final Corrections
73°	−0.27°	−0.35°	−0.62°
74	−0.30	−0.40	−0.70
75	−0.33	−0.41	−0.74

and so on to 83 degree range.

Corrections for Exposed Stem.

The corrections just determined apply to bore only and in order to obtain a total immersion (bore and exposed stem) a separate correction is necessary. If the correction for the standard thermometer includes those for exposed stem or if corrected for "total immersion," as is customary, the correction determined as above will, when applied to the thermometer under examination, give the actual temperature of the bath; but the instrument cannot be said to be standardized for "total immersion." In the event of the standard thermometer having but one correction, i. e., being standardized for three inch immersion, a separate exposed stem correction will be necessary for both thermometers.

By using a three inch immersion there remains several degrees of mercury thread not exposed to the action of the heated liquid but exposed to the air. The correction which this necessitates is very large if the mercury thread extends very far above the surface of the liquid and if the difference of temperature between the bath and the mean temperature of the stem is very great. It may be computed approximately from the following formula:

Stem Correction equals		$a \cdot n (T - t)$
where n	"	number of degrees above surface of the bath.
T	"	indicated temperature of bath.
t	"	mean temperature of stem.
a	"	factor for relative expansion of mercury in glass expressed in degrees, which is about 0.00015 for Centigrade thermometers and 0.000086 for Fahrenheit thermometers at ordinary temperatures. This varies slightly with kind of glass of which stem is made.

Mean Temperature.

A reliable smaller thermometer is fastened by means of elastic bands to the thermometer under examination in such a way that the bulb of the smaller thermometer is opposite the middle of the mercury column of the other. Assuming that N degrees are exposed above the surface, the bulb of the smaller thermometer should be placed opposite N/2 degrees. Bring bath temperature to first point required for standardization, in the case under discussion, 73 degrees. Take reading on the smaller instrument and record. In the same way take the mean temperature for the complete range, (73–83), thus:

Indicated Temperature	Smaller Thermometer Reading
73	30
74	30
75	30
76	30
77	31

and so on, to 83 degrees.

It must not be forgotten that this is an approximate correction and for exact work should be extended. As an illustration, when working with a thermometer having 60 degrees emerging above the bath, a bath temperature of 80 degrees (indicated temperature), and a mean temperature of 30 degrees, then, if the approximate correction equals one degree the true correction is practically 1.01 degrees. This value is obtained by substituting the approximate corrected temperature, (obtained by above formula), for T in the formula itself. The double calculation involved brings the error to very small magnitude.

(To be Continued.)

FUTURE OF IRON AND STEEL IN B. C.

The British Columbia Research Council, in its report to the Council at Ottawa concerning the possibilities of developing an iron and steel industry on the Pacific coast states that while there is room for one large plant, provided it is assured of the whole Pacific coast market, there is not much likelihood of the iron and steel industries of British Columbia ever being developed to a great extent. There are at present two rolling mills operating in British Columbia using scrap iron and steel, and there is a prospect of starting an electric smelting furnace for the magnetite iron ore on a small scale in connection with other electro-chemical industries.

WOOD TESTING LABORATORY IN VANCOUVER.

There is in operation at the University of British Columbia, Vancouver, a Wood Testing Laboratory. Mr. L. L. Brown, a former member of the wood testing staff at McGill University is in charge of the work, and his assistants are W. J. Johnston, of Toronto University, J. A. Carson, of McGill, W. Templeton, late of R.N.A.S.

Prior to the cessation of hostilities, the chief work of the laboratory was testing Sitka spruce for aeroplane purposes, the nature of the tests covering bending; impact bending; compression parallel to and perpendicular to, grain; hardness; tension, etc. It is expected that the work of the Laboratory will be continued for the purpose of testing Douglas fir and in making a comprehensive study of its structural dimensions.

CHARACTERISTICS AND UTILIZATION OF LIGNITE.

S. M. Darling.

(Continued from January Issue.)

Almost all of these manufactured tar products have heretofore come from Germany. In 1913 the United States imported coal tar products of the value of $11,000,000 at initiating points and these when they reached the consumer probably cost double that amount. Millions of gallons of creosoting oils for preserving timbers have been imported annually. That supply is now cut off and the market value of these commodities on this continent greatly enhanced. It is not unreasonable to expect that in the future a large part of this demand for tar products will be supplied from these immense stores of lignite.

Possible Conservation of Petroleum and Natural Gas.

The bringing onto the market of the Texas lignite would release large quantities of Texas petroleum and natural gas for other uses, and the conservation of our petroleum resources is a more important matter than the average man appreciates.

Of our original supply of petroleum, 42 barrels per capita have been used and only 70 barrels per capita remain for the future. About half of the petroleum currently produced is used as fuel for steam raising. The possibilities in the use of petroleum and its products in connection with the navy, airplanes, the merchant marine, automobiles, motor trucks, tractors, etc., are so great and vital that before long it will be looked upon as an inconceivable folly that oil should ever have been used for steam raising, the most glaring economic perversion that this country has ever been guilty of. (Bulletin 102, part 6, U.S. National Museum.)

"The whole mechanical equipment of modern civilization is dependent upon lubricants made from petroleum. Its exhaustion spells commercial chaos or commercial subjection by the nation or nations that control the future source of supply from which petroleum will be derived."—M. L. Requa.

"Efforts are being made in France to introduce the distillation of lignite for tars. The Societe de Distillation des Combustibles, Paris, is constructing an improved Ziegler type of furnace similar to that used for the distillation of peat, a type yielding about 7 per cent. of tar.

"In one place in Germany, where the system was adopted, 70 to 80 per cent of marketable products was obtained from lignite tar, namely, 15 to 20 per cent. paraffine wax, 5 to 20 per cent. kerosene; 5 to 15 per cent. of creosotes and organic acids; the remainder being light products, petrol, etc., or heavy products such as gas-oils, and lubricating oils.

"Concurrently with the great interest taken in the development of the shale-oil industry in America, it is worth while to consider the possibility of utilizing the large deposits of low-grade lignites for another set of greatly needed chemicals, including the fixed nitrogen which can be converted into ammonium sulphate. Among the available products are benzol and toluol, and the gas can be employed in many places for industrial purposes." (Mining and Scientific Press, May 11, 1918.)

If we are to prevail against our enemies in time of war and maintain our commercial prestige during peace, we must not be less diligent than either friends or foes in the matter of developing and conserving our natural resources.

In respect to the world's future demand for fuel oils, the *London Financier*, the leading financial paper of London, says in a recent issue:

"Of all the commercial propositions of the world, probably none has greater potentialities than the oil industry. Although throughout the centuries a staple product of the earth, oil, until comparatively recent years, was never utilized to any extent as a motive power, owing to the poverty of invention in respect to engines adequate for its proper exploitation in that respect.

"The war, however, has brought about many wonderful changes, necessity having truly proved the mother of invention, and, among other things, oil engine invention has received a vast stimulus, with the result that perfection in the manufacture of the necessary machinery is now being rapidly approached and, at the same time, scope for the usefulness of liquid fuel enormously extended.

"It is indeed quite reasonable to prophesy that the next generation will witness the practical disappearance of coal as the motive power for railways and ships, so that 'King Oil' may become a greater potentate on both land and sea than the veteran monarch of motion, 'King Coal.'"

A market for the fuel oils derived from carbonization of lignite is assured.

Advantage In Carbonizing Lignite.

A number of substantial economies from the mine operators' and coal dealers' standpoint become available through this method of carbonization of the lignite.

The prime advantage is that the lignite is changed from an unstable commodity into several stable and valuable products, the demand for every one of which is large and increasing.

In the use of raw lignite, under present practice thousands of tons of screenings are annually wasted. The coal is forked over in the mine room and screened again at the surface when being loaded into railroad cars. If the problem is handled as outlined above, this waste would be eliminated,—every pound of clean lignite broken from the seam would be put to some profitable use.

The raw lignite can not be stored economically; the treated product can; and this results in another large saving, in that it would enable the mines to operate under stable conditions the year round, instead of only during the winter months, as at present.

Some study should also be directed to designing appropriate apparatus for the consumption of these classes of fuels instead of using devices already on the market intended to consume fuels of quite different character.

Unquestionably the experiments so far conducted open very large economic and commercial possibilities, and it is believed that a little wider and more thorough investigation will point the way for the establishment of carbonizing and briquetting plants throughout the lignite-bearing sections of the country, thus bringing effectively into the industrial world one of our largest natural resources. The results will be not only the production of a first-class solid fuel, so much needed, but the saving of many by-products valuable in war as well as peace, and the easing of overburdened transportation conditions throughout the country.

In conserving the coal supply and in increasing the electrical power supply of the country, lignite resources must be developed as well as water powers.

There are several uses for the lignite retort gas, as a town gas, as a furnace fuel, and in a gas engine. There are also several uses for the carbonized residue, in gas producers, on stokers, or in briquetted form. Therefore, it ought not to be difficult to market in one way or another either of these products no matter how large the demand

for the other might become. It is not easy reasonably to conceive a limit to the market for sulphate of ammonia or hydrocarbon oils and tars.

These different products can be used in so many ways that an industry of this kind could readily be made to fit the industrial requirements of any ordinary community.

The carbonizing of this lignite will place the lignite-bearing regions on a par from a fuel and power standpoint with those parts of the country that are favored with bituminous coals. It will give a better domestic fuel in the way of carbonized lignite briquets, a better gas producer fuel in the form of carbonized lignite, enormous quantities of gas to be used for fuel or power purposes, large quantities of fertilizer in the form of sulphate ammonia, and a great amount of oils and tars. And the by-products derived from this process should more than pay the cost of making the transformation.

THE FUTURE OF THE BARIUM INDUSTRY IN AMERICA.

According to Mr. Hugh Rollin, who gave a most interesting address on this subject at the meeting of the American Institute of Chemical Engineers at Chicago, Jan. 15th, the future of the Barium industry is almost entirely dependent upon whether the United States Government raises a protecting tariff or not. Mr. Rollin is President of the Rollin Chemical Co., of Charleston, W. Va., and believes that an era of tremendous competition in those materials which have been produced since the beginning of the war is upon the United States.

As far as the Barium industry is concerned the chief causes for this condition are:

1. The industry is in its infancy and is neither well established nor financially strong.

2. The makers of machinery suitable for this industry are lacking in experience and many of their products appear quite crude in comparison with some of the European machinery.

3. For some unknown cause Barium products have always been manufactured on a very small margin of profit.

4. Wages in the United States are at least one hundred per cent. higher than in other countries.

5. Freight rates keep rising and ocean shipping becomes daily in better shape than it ever was.

6. The Governments of Europe encourage consolidation and amalgamation of various interests engaged in chemical industries, purely for the idea of strengthening their position and financial condition. In America the tendency is to destroy consolidation.

Mr. Rollin demands protection through tariffs at once. In Canada, some interest was taken in the development of the Barium industry, at Kingston, about two years ago. These efforts, however, fell through for various causes, the chief of which was lack of capital, although poor management also throttled the effort. In many ways what is true of the Barium industry for the United States is true of many possible chemical industries here. They would grow and could live if given half the encouragement that some other industries have been given in other countries and in Canada in the past.

Barium Products.

As far as the volume of business is concerned, the Barium industry is active or inactive in direct proportion to the business activity or inactivity of the Country as a whole.

Barium products, including Barium Peroxide, Barium Chloride, Barium Nitrate, Barium Carbonate, Barium Sulphide, etc., depend for their sale on so many diversified interests that the volume of business which can be done in them is a very good index as to the general condition of business throughout the country, and the stoppage or the elimination of the barium industry would have a very deleterious effect on a great many other industries. For instance:

Barium Peroxide is used in times of peace for the manufacture of U. S. P. Hydrogen Peroxide and as a bleach, especially in the straw hat and blanket industries.

Barium Sulphate (Precipitated), generally known as Blanc Fixe, is used in the manufacture of automobile tires, in the paper industry, in making printer's ink, in pigments and in many other ways.

Barium Sulphide, or as it is commonly known, Black Ash, is the second principal ingredient of Lithopone.

Barium Carbonate, has such widely diversified uses, as in the manufacture of scumless brick, in rat poison, in the manufacture of high grade optical glass, etc.

Barium Chloride, is largely used in the dye industry, is absolutely necessary in the manufacture of photographic materials and enters into the manufacture of a great many other chemical compounds.

Barium Hydrate finds its largest use in the beetroot sugar industry, etc.

Barium Nitrate, enters into the manufacture of fire-works, detonators, railroad signals and, of course, enters very largely into munition making, as well as having numerous other peace time uses.

Sodium Sulphide, while it can scarcely be talked of strictly as a Barium product, is, nevertheless, a direct result of the manufacture of Barium products; it is absolutely essential to the making of Sulphur dyes and is the most largely used depilatory in the conversion of hides into leather.

Summing the whole situation up Mr. Rollin said: "I have only mentioned a very few of the uses of Barium products, but enough I hope to allow you to readily see of what importance these uses are and to give you an idea of the necessity of making conditions such that the Barium industry will not perish.

To sum up, to put the Barium industry on a sound commercial basis, we require first, a strong tariff wall; second, reduced freight rates; third, the right to organize, and fourth, a little more consideration from the Government in the matter of taxes. Given these four items, I would say, that the Barium industry in the United States has a great future."

ALCOHOL FROM PEAT IN SWEDEN.

Peat is found on thousands of hectares and at a depth of seven to eight meters (22.96 to 26.25 feet). From 100 kilogrammes (220 pounds) of dried-peat substance about six liters (1.58 gallons) of 100 per cent. alcohol can be obtained. This is about the same yield as potatoes.

The method of extracting alcohol from peat is about the same as by sulphite. The peat is boiled under pressure with sulphuric acid, by which a sugar solution is obtained and some residue products. After the acid has been neutralized with lime, the sugar solution is made into alcohol, the peat residue being collected and made into briquettes for fuel.

The experiments made with regard to this method of extracting alcohol have been successful, and the Swedish Government has agreed to the building of a factory.

ANNUAL MEETING OF CHEMICAL ENGINEERS.

From January 15th to 18th, the chemical engineers of the United States held their eleventh annual meeting at the Congress Hotel, Chicago. As was to be expected, some very timely papers were given. The meeting was one of more than ordinary importance. Questions dealing with the relationship of the chemical industries of the United States to those of Europe were discussed. The United States has created a wonderful chain of chemical industries during the war period, but it yet remains to consolidate them. Assistance from the Government is asked in order that foreign underselling may not drive away the capital already attracted to these fields in America. Following the recent report of the Tariff Commission on the American dye situation, and what should be done to assist this particular branch of industry, the paper by Dr. Grinnell Jones was of first importance. The drafting of technical legislation in the field of organic chemistry is most difficult and the United States Government is obtaining its facts through a commission which in turn has the advice of capable chemists. The Tariff Commission recommends further protection and it is probable that a new act covering their recommendations will be brought up. The thoroughness with which the United States Government is looking into these practical movements of protection is something that the Canadian Government might well note. The next report of this Tariff Commission will deal with a group of acids: boric, formic, oxalic, lactic, citric, tartaric, tannic, gallic, and pyrogallic. Competitive conditions under which these may be made home industries in the United States will be considered. A report dealing with heavy chemicals is under consideration.

Mr. Hugh Rollin of the Rollin Chemical Co., Charleston, W. Va., gave an excellent paper on the production of Barium Compounds and the future of this industry. Here again protection is necessary. This paper is given at length elsewhere, and is interesting to Canadian readers from the fact of important deposits in Canada of the ores from which barium is produced.

Dr. Edward Gudeman, Consulting Chemical Engineer of Chicago, and consulting chemist to the Canadian and Edwardsburg Starch Companies, gave it at his opinion that Canadian conditions are more favorable to Canada than American conditions are to the United States, as far as dumping laws are concerned.. Laws applicable to larger American industries cannot be well applied to produce or protect smaller investors. Dr. Gudeman spoke at length on the problems of reconstruction. He pointed out the struggle was in a new sense a chemical war, and it will be necessary to have a chemical reconstruction. Everything is having its chemistry flashed upon the public eye, and yet in Illinois the only two scientific professions that may be followed by anyone without a license, are those of Cooks and Chemists. Everything that was so forcefully applied to United States conditions is equally applicable to Canadian. This was especially true when the question of exporting raw materials was up for discussion. We need real manufacturers, not shipping clerks, operating on our natural resources.

David Wesson of the Southern Cotton Oil Company gave a most interesting paper on engineering developments in the oil industries, pointing out the development of the work now done by chemical engineers and showing how a lack on the part of operators of a knowledge of chemistry may lead to great losses and delays.

Maximilian Toch, after reviewing conditions as they exist to-day in the United States Chemical Industries, presented the following suggestions:

(1) A reasonable tariff.

(2) An amendment to the Sherman Act allowing competitors to co-operate.

(3) A law, or ruling, effective without going before Congress, so that foreign materials underselling American cost of production may be held in bond until proper investigation is made, in order to prevent disruption of American Trade.

(4) The source of origin of every material must be stated by the foreign shipper under oath.

(5) No combinations in restraint of trade should be permitted by foreign countries against the United States, and wherever a foreign competitor sells goods at below the cost of American manufacture, their importation shall be prohibited.

Many papers were given by the manufacturers and representatives of various chemical industries. Visits were made to the plant of the Corn Products Refining Co., at Argo, Ill.; The Lindsay Light Co., Chicago; the Underwriters' Laboratories; as well as the new plant of the Standard Oil Company, at Whiting, Ind.

RADIUM vs. MESO-THORIUM IN LUMINOUS PAINTS.

In 1905, Han discovered meso-thorium. The increasing uses of radium for medical work and luminous paint has made the question of radium substitutes an important one. During the war, radium found uses in the dials of instruments on airplanes, electric push-buttons, door numbers, and in a variety of other small ways. As a substitute for radium, meso-thorium is of first importance. It is a radioactive element found in thorium minerals and monazite sand in particular. In the manufacture of paint, the freshly-extracted element is allowed to ripen for several months. During this period, the alpha radiation required for luminous paint becomes much stronger. For medicinal purposes, it may be used within a few days, as the beta and gamma radiation grows rapidly. For luminous paint purposes, the life of meso-thorium is from five to six years, while that of radium is 1,600 years. During this period, radium decays one-half. For products of equal activity, the price of meso-thorium varies from 40 to 60 per cent. of that of radium. For medicinal purposes, radium is much better than meso-thorium, while for luminous paints to be used on objects which themselves have a short life, meso-thorium is much cheaper and equally good.

Canadian Sources of Monazite, as given in Geological Survey Reports, Ottawa, Memoir 74:

The mineral is described as a phosphate of cerium, lanthanum, didymium, sometimes with silicate of thorium. It has been discovered in British Columbia on the Quesnel River, about eight miles above its junction with the Fraser River. In Nova Scotia, it occurs in Lunenburg County, near Lake Ramsay. In Quebec, it has been found at the Villeneuve mines in Villeneuve. No other localities are given by the Geological Report.

RICH FIND OF RADIUM LODE.

A valuable pitchblends lode has been discovered in Devonshire, England. What is said to be a fair sample shows a uranium oxide content of more than 26 per cent.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa.

Trade and Commerce, Ottawa.

(Notice.—Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same).

Department of Agriculture.

Annual Report of the Department for the year ending March 31, 1918, 96pp. Price five cents.

Report of the Dominion Experimental Farms for the year ending March 31, 1918, 96pp. Price ten cents.

Canadian Bark Beetles, (Part 1.) Price twenty-five cents.

Applications for the above mentioned publications should be addressed to the Chief of Distribution, Department of Public Printing and Stationery, Ottawa.

Board of Railway Commissioners for Canada.

Judgments, Orders, Regulations and Rulings, (Fortnightly edition), Volume VIII. Annual subscription $3.00.

Twelfth Annual Report of the Board of Railway Commissioners for the year ending March 31, 1917. 108pp. Price ten cents.

(Supplied by the Department of Public Printing and Stationery.)

Customs and Inland Revenue.

Trade Report for 1917-1918. Price eighty cents. (Dept. Public Printing and Stationery).

Canada Food Board.

Live Stock—Canada's Opportunity. A six-page folder showing how Canada lags behind most other countries in the matter of intensive raising of live stock. Tables and drawings are given outlining wherein the live stock production in Canada might profitably be largely increased.

Department of Trade and Commerce.

Food and Drugs Laboratory Bulletin No. 410. Alcoholic, Patent and Proprietary Medicines. 7pp. Owing to the recent enactment of certain laws intended to diminish or abolish the use as a beverage of alcoholic liquors, the Food Laboratory which administers the Proprietary and Patent Medicine Act has frequently been asked lately regarding the possible use as a beverage of certain medicines extensively advertised in the Canadian press, which are known to contain alcohol in more or less considerable quantities. In order to answer these questions intelligently, the Chief Analyst caused to be collected 208 samples considered representative of those on the Canadian market. 44 samples, representing 34 different brands are found to be entirely free from alcohol. The names of these are arranged in a table. 164 others contain notable amounts of alcohol, and they have been sorted according to the following two questions:

(1) Is the content of alcohol justified by the nature of the article?

(2) Would it be possible to make use of the article in order to obtain its alcoholic effect?

59, comprising 45 kinds are thus found not available as a beverage. 78, representing 39 preparations, might be used as a beverage, although in many cases it would be necessary to dilute the medicine largely before such use. The per cent. alcohol and the kind of medication are given.

The Honorary Advisory Council for Research.

Report No. 3. The De-Tarring of Gas by Electrical Precipitation. 41pp. 4 drawings. By J. G. Davidson, Ph.D. The work described was done at various times during the last four years at the University of British Columbia, the actual commercial trials and experiments being made at the plant of the Algoma Steel Co., at Sault Ste. Marie, last winter. The latter phase of the work was made possible by the technical and financial assistance rendered by the Advisory Council. This report constitutes the first published account of any portion of the work. Dr. Davidson first discusses the theory of electrical precipitation and applies the principles to the technical side of the work. Experimental work carried out by the author at the plants of the Vancouver Gas Co., and the Tacoma Gas Co., is described at length, and general considerations relative to the distillation of wood are given in order that the subsequent account may be the more readily understood by the reader. A full account of the work done after the Advisory Council gave its assistance ends up with the conclusions that "Successful tests of the process of electrical precipitation for the de-tarring of gas on a commercial scale have thus been made in wood, coal, and petroleum distillation plants," and that "it is highly desirable that installations of one of each of the various types of distillation plants should be made at once . . . . for the purpose of developing a more efficient by-product collection process."

Dominion Bureau of Statistics.

Monthly Bulletin of Agricultural Statistics. November. A note is made of the report on "The International Movement of Fertilizers and Chemical Products useful to Agriculture," published by the International Institute of Agriculture. The production and trade in natural phosphates, basic slags, ammonium sulphate, and sulphur; potash and nitrate of soda are given by seven leading countries, and the prices of artificial fertilizers at United Kingdom and New York ports for the past three years are given in another table.

Commercial Intelligence Branch.

News of export and import value; trade opportunities; Canadian grain statistics; Government notices, and rulings of other lands affecting Canadian trade.

Monthly Report of the trade of Canada. 365pp. The trade for the month, for the same month last year, and for the seven months ending October, 1916-17-18.

MODIFICATIONS IN RESTRICTED IMPORTS.

Many changes and modifications regarding import restrictions have recently been announced by the United States War Trade Board. Among the articles mentioned as now being open for import are: All acids; fluorspar; nickel; all expressed vegetable oils; non-mineral paints and varnishes, and zinc. The regulations also governing the importation of copper ore and copper concentrates have been greatly modified, while the restrictions upon the importation of copper matte or blister copper have been removed. In a new ruling the U. S. War Trade Board announce that applications for licenses to import dyewoods and other natural dyestuffs will now be considered.

A CANADIAN NATIONAL RESEARCH INSTITUTE*

The Aims, Scope, and Proposed Organization of a Research Institute to be Situated at Ottawa, Working in the Interests of Canadian Industries.

By A. B. MACALLUM, F. R. S.

A system of Trade Associations, has been adopted by the Research Council of Canada. There are about a dozen lines of industry in which what are to be called Trade Guilds for Research may be formed, and amongst them may be mentioned the Tanning, the Textile, the Pulp and Paper, the Fisheries, the Furniture, the Rubber, the Iron and Steel, and the Clay Products industries. These all are important to the industrial development of Canada, and, if the firms in each of these could be brought to co-operate for research on their special problems, the result would be greatly to their advantage in their struggle to win against outside competition. Unfortunately, the number of firms in any particular industry are fewer, and, with some exceptions, of smaller capital and output than those in Great Britain and, consequently, the funds which they may pool for research cannot be of a magnitude to compare with the funds at the disposal of the British Trade Associations. It must also be recognized that public opinion is not yet such as to sanction direct public aid to supplement the funds of a Guild as it is given in some of the Trade Associations. The latter are, in the majority of cases at least, to provide and maintain their own laboratories. If the Guilds for Research could be given free accommodation, light and heat and, where necessary, motive power, in some Central Research Institute, their funds could therefore be expended for their research problems alone, not by any means a small advantage. If, further, all the Guilds having problems more or less related were similarly aided, their association in a Central Research Institute would promte the success of such Guilds and they would have the advantage of the supervision of the staff of the Institute composed a sit ought to be of a number of very highly expert specialists in research in the various fields of pure and applied Science.

The information and the successful working of such Guilds in Canadian industries, therefore, depends on the establishment of a National Research Institute. Through such Guilds only can the Canadian industries as a whole be assisted to meet the needs in scientific research which the conditions of to-day impose on them. The question, therefore, of founding a National Research Institute is, from this point of view, an urgent one and it is so regarded by the Research Council which has recommended the establishment of such an Institute.

There are other reasons also, which have contributed to this action by the Council. There ought to be a central organization amply equipped to undertake research on general problems affecting the utilization of our natural resources and on general problems affecting the industries generally. The need for such is recognized elsewhere and in some cases it has been met by the foundation of Institutes whose work has been of immense service to industry. Germany has two of such, one for physical standards and research at Charlottenburg, the other for chemical research at Dahlem. For Great Britain there is the National Physical Laboratory at Teddington, which concerns itself with researches along all technical lines except the chemical. The Bureau of Standards at Washington, as its name implies, deals with standards of all sorts, physical, chemical, electrical, metallurgical and even industrial, but it also undertakes research problems for the industries. It has in the seventeen years of its existence given splendid service in these lines to the nation. A National Research Institute is now being established in Japan and already a fund of $2,600,000 has been collected for it, more than half of which has been contributed by the Diet and the Emperor personally. It is expected that the fund will eventually amount to $4,000,000. The functions of this Institute will be those of a Bureau of Standards and a Mellon Institute, but research on the industrial side will be specially provided for. A proposal made by the French Academy of Sciences for the Establishment of a National Research Institute for France is now under consideration and the present indications are that as soon as Peace is established such an Institute will be brought into existence. The Australian Advisory Council of Science and Industry has recommended to the Government of the Commonwealth the foundation of an Institute of Science which will carry on work and researches in standardisation of scientific apparatus, of electric lamps, apparatus and machinery, of instruments of precision used in industry and of materials used in industry and by the Commonwealth and State Governments of Australia. It will, as recommended, also undertake research work in forestry, mining, metallurgy and on the processes and methods concerned in the manufacturing industries with the view of aiding the development of the latter.

The fact that a number of such Institutes are in being and operation elsewhere and that the establishment of others is under contemplation brings strong support to the recommendation of the Research Council that a National Research Institute for Canada should be established. There is no such organization as yet for Canada which fulfils even an important fraction of the functions of such an Institute. The needs of the Dominion in this respect are urgent. The position of our industries in the face of keen, incessant competition from abroad cannot be ignored and the utmost resources of Science must be brought to their assistance. To do all this a great organization must be brought into existence, one of whose functions will be the initiation and conduct of the researches on basic problems affecting the industries. That organization would centre in the management and staff of the proposed Institute which would be centrally situated, at Ottawa for example, or possibly, eventually, with branches at points in the Dominion where special local needs require the establishment of such.

Associated with this function of investigating the basic problems of the industries must be that of superintending and guiding the researches on the various problems in which the Guilds for Research formed in the various lines of industry are concerned. This would necessitate, except in very special cases, the accommodation of the research staffs of such Guilds in the buildings of the Institute. Such a close association for research, of the various industries some of whose individual problems would be allied or closely related, would enhance the chances of success in attending the objects of all the Guilds. The very fact that the research staffs of these would be constantly under the supervision of the staff of the Institute, composed as it ought to be of the most highly qualified experts that can be found, would promote the formation and maintenance of such Guilds in all the lines of industry which would profit by the application of research to their problems. The industries of Canada would thus, it is safe to say, be

assisted to a degree out of all proportion to what they would expend or to the cost of maintenance of such an Institute.

There are firms in the industries which, because of the large capital they possess and their receipts, are able to undertake their own research work, and, therefore, do not require any assistance such as is proposed. The number of such may increase as the years pass and, therefore, private initiative and enterprise in research will always be cultivated as it has been in the past, with excellent results. If, however, only such firms were in a position to apply research to further their development, the result would be the disappearance of the smaller firms either by absorption into the larger or by extinction, for the larger firms would through the results of research be put in a position to control, and would control, all the valuable processes of manufacture through patenting their discoveries. This undesirable result is beginning to be ex emplified today in the United States. One firm, by way of illustration, which spends half a million dollars annually for research, controls consequently a very large number of patents, the exclusive use of which by it prevents competition and tends to give it a monopoly of the market not only of the United States, but of the world. To enable the smaller firms in an industry to live, and, better, to succeed in efforts to do more than hold their own in keen competition, Guilds for Research must be established for them, fostered and guided as they would be according to the scheme of the proposed National Research Institute.

The Research Institute should have also other functions than those already described. It should concern itself with standards of all sorts, but, more particularly, those which are immediately related to our technical and industrial needs. They should embrace those of thermometry, pyrometry and heat measurement, electricity, optics, chemistry, metallurgy and the materials used in engineering construction. It should conduct investigations on metals, alloys, coal, paper, oils, rubber, bituminous materials, ceramics, textiles, leather, paints, etc. It should also be a testing house for all instruments of precision used either in the service of the Government or of the industries. These functions should be provided for in the equipment of the Institute at the outset, although not on a scale that would be required a few years later. The beginnings along this line must not be too ambitious, but yet should be sufficient for our present needs.

What the ultimate development of the proposed Institute's activities along this line may be may be gathered from the scope of the work undertaken by the Bureau of Standards at Washington.

The proposed Institute should be under the control of a Director whose qualifications and experience must be such as to fit him for this very responsible position. The staff should include a number of highly qualified research men of special initiative and originality, to direct the work of their special departments and associated with them should be a number of investigators specially selected because of their training and ability to conduct productive research along special lines. The salaries for the members of the staff in their various grades should be such as to secure the very best appointments.

It is recommended that the proposed Research Institute be established at or near Ottawa, on a site of at least fifty acres in area and within reach of the city water, gas and electric power supply. The building should be of the laboratory type, of solid construction with cement floors, four stories in height in addition to a basement and of dimensions 200 x 60 x 70 feet, in which besides corridors and office adminstration quarters there would be at least 50 laboratory rooms. The Council has recommended that an appropriation of $500,000 be made for the building, one of $100,000 for its scientific equipment and one of $100,000 for salaries for the staff and the maintenance of the building, for the first year.

These recommendations have been accepted by the Reconstruction and Development Committee of the Cabinet and final action will be taken on the recommendations by the Cabinet as a whole in the next few weeks.

It is also proposed, should the recommendations regarding the National Research Institute be accepted, that an Associate Advisory Committee be constituted of representatives of the Canadian Technical Societies, the Manufacturers' Association, the scientific staffs of the Universities, and of the Agricultural and Labor interests, whose function it will be to review the work of the Institute and report annually to the Governing body such recommendations, the adoption of which, in its opinion, will enhance the usefulness and service of the Institute to the Dominion. This will bring to bear on the work of the Institute forces which will prevent waste of efforts, slackness and other defects, which might develop in its work or organization. It will also keep the governing body and staff in direct touch with the opinion of the sections of the public most vitally interested in its success.

If the recommendations of the Research Council are accepted at once, not only an organization but a policy will be inaugurated which will place Canada in the front rank of those States which are trying to prepare for the strenuous international industrial struggle that is soon to begin. The results of this policy will be far-reaching, not only in the industries but also in stimulating scientific research in our Universities and in promoting the best interests of the technical professions of Canada.

*Part of an address delivered before the Toronto Branch, Society of Chemical Industry, January 23, 1919.

ENEMY CHEMICAL COMPANY SOLD.

The Sterling Products Company, of West Virginia, have purchased the Bayer Company and subsidiaries for $5,-310,000. The sale was made by A. Mitchell Palmer, the United States Alien Property Custodian. The pricipal pharmaceutical product of the Bayer Company was aspirin. Its annual business amounted to over $4,000,000. It was the largest German-owned chemical plant in America, and had twenty buildings and seventy-five acres of land at Rensselaer, N. Y. The Company had equipment for making dyestuffs and intermediates, including nitric acid, sulphuric acid, nitrate plant, hydrochloric acid plant, nitrobenzol, dinitrochlorbenzol, and dinitrotoluol, aniline oil, and amido oil.

NOTICE: A CORRECTION.

In our January number, the source of the article by W. S. Landis was inadvertently omitted. This article on "The War and the Nitrogen Industry", should have been credited to the American Electrochemical Society, having been read at their meeting at Atlantic City, on October 1, 1918.

Chemistry Applied to Gas Works

Mr. W. A. Twine, Superintendent of the Birmingham Gas Department, Birmingham, England, makes come excellent suggestions in a recent article given before the Midland Association of Gas Engineers, and reported in the Intercolonial Gas Journal. He tells us that the successful gas engineer of the future must be a chemical engineer in more than name only. By-products must be recognized as of primary, and not secondary, importance. Patents for gas works will rarely succeed unless they be the product of a scientist and engineer who is at the same time a chemist. It is the combination that ensures success.

Four processes depending for their success on chemical engineers are discussed:

1. Purification of gas by means of ammonia.
2. Recovery of nitrogen compounds as ammonia or cyanogen.
3. Recovery of cyanogen compounds from coal gas and residuals.
4. Manufacture of ammonium chloride.

Ammonia Purification.

In ammonia purification, the distilled ammonia is used to absorb such impurities as carbonic acid and hydrogen sulphide. The ammonia, when saturated with these gases, must be treated in a manner which will eliminate both gases in a single vessel, leaving the liquor for washing purposes; or it may be distilled and only the pure ammonia gas used for further absorbing. The heat required for these operations is obtained from the waste heat of the retort-house. The products of the excess ammonia are, sulphate, liquid, anhydrous, or salts.

In general, present practice in the distillation of ammonia is said to be faulty and is deserving of further research work. The amount of steam necessary to drive the ammonia from the vessels brings the cost up. In theory, apparatus is needed which will give up H_2S and CO_2 in one section and yield ammonia in another, which ammonia, when once freed, ought never to be allowed to combine again in the apparatus.

Gas Works Sulphric Acid.

It is predicted that all large gas works will produce both ammonia sulphate and sulphuric acid in the near future, using the sulphur in the coal. This acid would be free from arsenic and should make fine salts at low cost.

Ammonium Chloride.

One of the big fields in gas works practice is ammonium chloride. When the coal in a retort reaches 1,650 deg. Fahr., the salt present is decomposed. The acid radicle combines with the silicate of the retort. The temperature of the gases leaving the retorts is about 1,400 deg. Fahr., while in the hydraulic main they drop to about 200 deg. Fahr. On leaving the hydraulic main, the temperature of the gas falls to about 100 deg. to 150 deg. Fahr., so that the greater quantity of ammonium chloride remains behind up to this stage, seeing that it is a fixed ammonium compound. By removing the tar as quickly as possible—by running it through a tar tower, and so saving the possibility of it thickening—and circulating the condensate, we can obtain a concentrated solution of ammonium chloride. This is constantly run off into a purifying tank, where such impurities as thiosulphates, iron, and organic matter are removed—the former by slightly acidifying with a correct mixture of hydrochloric and nitric acids, when the sulphur separates out; while iron which is present as protoxide, and certain organic compounds, are removed by air blowing while the solution is still hot.

When filtered, the liquor is evaporated in a continuous cast-iron evaporator (of the Kestner type), after which it is to be run into crystallizing tanks, or, better still, a continous crystallizing process may be adopted by running the liquor into a long semicircular leaden trough, pitched at a slight angle, and kept rocking by a mechanical appliance fixed at the ends. The crystals thrown out of the mother liquids are drained, washed and recrystallized. In some cases, owing to organic impurities which interfere with the color of the crystals, it may be necessary to evaporate to dryness and heat the salt (for a period) to nearly volatilizing point, afterwards dissolving in water, when the carbonaceous matter is rendered insoluble and the filtered liquor is crystallized.

The author is of the opinion that it ought not to be necessary to purchase hydrochchloric acid for the manufacture of ammonium chloride, as not only can the value of this acid be saved and a valuable salt be obtained, but by such a scheme the cost of distillation of gas liquor in the manufacture of sulphate of ammonia would be materially reduced, owing to the saving of lime which is necessary in liberating the fixed ammonia—the greater portion being chlorides—from the ammoniacal liquor. The steam required for distillation would also be considerably reduced.

In Canada, where we import ammonium chloride paying a stiff duty, it would seem that some enterprising company might find a very fair field. During the war ammonium chloride was manufactured in this country, but by costly methods, and it is not likely that its manufacture will be continued unless taken up by some company able to produce it as a by-product.

Cyanogen Compounds.

Either sodium ferrocyanide or ammonium sulphocyanide may be produced. For ease of working, the latter method is best. In order to extract cyanogen, the coal gas must be free from tar and tar oils. The limit is 4 grains per 100 cubic ft. In the Birmingham gas works the following method is used:

"Our largest ammonium sulphocyanide plant deals with between 10 and 11 million cubic feet of gas per day. The plant consists of six cast-iron boxes, 25 ft. square by 6 feet deep, constructed of plates 3-4 in. thick. Each box is fitted with two wrought-iron covers 3-16 in. thick, which can be removed and lifted by means of pulle yblocks hung from an overhead runway. Wooden grids are supported by cast-iron bearers 9 in. from the bottom of the box; and on these, hard-fused spent oxide (of about 50 p. c. sulphur) is laid to a depth of 21 in. It is very important, however, that the oxide be graded as follows: First layer, 8 in. of 4 in. material; second layer, 6 in. of 2 in. material; third layer, 4 in. of 1 in. material; fourth layer, 2 in. of 1-2 in. material; top layer, 1 in. 1-4 in. material. In this way the boxes are kept free and open, and do not throw more than 5-10ths back pressure, not even after working for two or three years.

The method of working is as follows: Before the gas is opened into the boxes, the oxide is well wetted with clean filtered water through very fine spray jets. There are eight to each box, four on each opposite side. After this operation, the coal gas is admitted in three streams through mains on the bottom of boxes Nos. 1, 3 and 5, passing up through the oxide and into boxes Nos. 2, 4 and 6 by long openings in the division plates between Nos. 1 and 3, Nos. 2 and 4, and Nos. 5 and 6. The gases travel in a downward course through Nos. 2, 4 and 6 boxes, and join in a

common main, leading to the ammonia scrubbers, and thence to the oxide purifiers. Each week the direction of gas travel is reversed; so that the inlet gases during the second week divide into three parallel streams and pass up through Nos. 2, 4 and 6, and down Nos. 1, 3 and 5 boxes. There are valve arrangements allowing of this reversion.

According to the strength of the ammonium sulphocyanide made, so is the amount of water sprayed into the boxes. The time occupied in this spraying will vary between ten and sixty seconds every two hours, according to the cyanogen content in the gas, and also the amount of moisture condensed from the gas, due to atmospheric conditions. We aim at obtaining a solution containing not less than 2 lbs. of ammonium sulphocyanide per gallon. This solution is run off continuously through a 3-in. cast-iron pipe, into store tanks, and analyzed once a day. Providing the inlet gases are free from tar and oils, the boxes will work for very long periods without recharging the oxide. At present, we have boxes which have been in continual use for nearly three years, and are extracting cyanogen from 10 million cubic feet of gas per day. There should be not less than 1 to 1 1-4 p. c. of free oxygen in the gases passing through the boxes; otherwise the sulphur of the oxide is quickly reduced. The temperature of the inlet gases should be controlled to read about 80 deg. to 90 deg. Fahr. —this giving the best results."

THE TANNING TRADE.

Leather Trades Review gives an account of a lecture delivered recently by Charles E. Parker on the progress of the tanning industry in England during the last forty years. When Mr. Parker started tanning in 1878, tanneries were small, the work was done entirely by hand, wages were low, and the tanning materials, oak bark and valonia, were poorly ground and poorly leached. Since that time, many new tanning materials, such as hemlock, chestnut and quebracho extracts, have been introduced. Although wages have greatly increased, the introduction of extract, together with other saving devices, has cut the cost of tanning from 5d. per pound of leather in 1878 to 1 1-2 d. in 1913.

New machinery has been continuously introduced, the very latest being a mechanical liming proposition, all of which save both time and labor, and improve the appearance, the grain and the quality of the leather. He dealt lightly with the development of chrome tanning with which he has not had much experience. He, however, laid great stress on the importance of chemistry to the tanning industry. Great credit was given to H. R. Proctor and Dr. Gordon Parker for their work as instructors in this line. Mr. H. R. Proctor was one of the first leather chemists and for the last forty years has stood at the head of the world's science of leather manufacture. Mr. Parker laid stress on the chemist having received special training in leather chemistry. War conditions have brought the tanning chemist to the front and he has become almost indispensable to the English tanning industry.

SALTERS' INSTITUTE OF INDUSTRIAL CHEMISTRY.

Salters' Company, of London, England, have founded an institute to promote research in chemistry for industrial purposes, and to train students, under the name of "The Salters' Institute of Industrial Chemistry," with temporary premises at Salters' Hall, St. Swithin's Lane. The object of the institute is to invite co-operation between manufacturers and students at the universities for the investigation of matters requiring research. The company intends establishing two types of fellowships, eligible to post-graduate students of any recognized university—one to enable post-graduate students to continue their studies at an approved university or institution under the supervision of the Director of the Institute; the other to enable suitably equipped chemists to carry on research work for any particular manufacture, an agreement being entered into between the Institute, the manufacturer and the Fellow. The Director of the Salters' Institute has already been appointed, in the person of Mr. Martin Onslow Forster, F.R.S., D.Sc. (Lond.), and he will enter his new duties at an early date. Dr. Forster is a distinguished chemist, who, from July, 1915, up to the present time has been Chairman of the Technical Committee of British Dyes, Limited, and also, until recently, a member of the board of directors of that company. He is honorary treasurer of the Chemical Society, and a member of the Council of the Royal Society.

ANNUAL REPORT, CONIAGAS MINES.

Coniagas Mines, Limited, have issued their annual report showing a surplus of $1,533,326.46 as on October 31st, 1918, and that in spite of the fact that during the fiscal year there was an increase of over fifty per cent. in the cost of production over that of the previous year.

The mine manager, Mr. F. D. Reid, states that the broken ore in the mine amounts to more than one year's requirements.

During the year the Coniagas Reduction Company shipped 2,390,737 ounces of silver, and there are at present over 1,000,000 ounces in process of reduction.

MANUFACTURE OF ARTIFICIAL SILK.

"The Chemical Engineer" for December contains an abstract from The National City Bank, New York, on the subject of "Our Increased Manufacture of Artificial Silk." This product, which is used principally in the manufacture of stockings, is made by treating wood pulp with caustic soda to form a sodium cellulose and is then dissolved in carbon disulphide, producing alkali-cellulose-xanthate or "vicose." After being filtered and allowed to ripen by standing it is forced through minute holes into a liquid which solidifies the threads. The silk goods made from this artificial fibre possess brilliancy, but have a somewhat harsh "feel."

In view of the practically unlimited supply of wood pulp in Canada, the manufacture of artificial silk might well provide a field for a live industry in various parts of the country where there is an abundance of wood suitable for the purpose.

INDUSTRIAL AND CHEMICAL STATISTICS.

Mr. S. J. Cook, B.A., A.I.C., of the Food and Drugs Laboratories Staff at Ottawa, has been loaned to the Dominion Bureau of Statistics where he has charge of the Census of Canadian Chemical Industries to be taken this year at the request of the Honorary Advisory Council for Scientific and Industrial Research. Several attempts have been made by various organizations in the past to prepare a review of the chemical industries in Canada, but this is the first Government move and also the first effort to make what is expected to be a comprehensive survey of the industries in Canada which may be described as "chemical." The selection of a chemist for this work is also new but is, we belive, a wise step, and the chemists of the country will look forward with confidence to the report of the work Mr. Cook has undertaken.

CONSERVATION OF FUEL.

By J. STEPHENSON.

(Continued from January Issue.)

It being accepted that the employment of artificial fuels would enable combustion to be better controlled, it remains for us to look into the possibilities of their manufacture. The fuels which bear the closest relation to coal in chemical composition and physical properties are lignite and peat, which differ only in that they contain a higher percentage of oxygen and moisture. The percentage of moisture in these fuels is a disadvantage in that it requires heat for its evaporation, whilst lignite has a further disadvantage in its ability to absorb moisture from the atmosphere. The use of these fuels in their natural state is therefore unpractical except in the vicinity of production, and for general use their original consistency must be broken up, and rebuilt into an artificial fuel. The fact that these fuels are non-caking renders their use unsuitable for the manufacture of coke, and a briquetting process is apparently the only practical way of converting them into useful fuel.

The method of briquet manufacture differs in various ways, but in all cases it requires heat to carbonize, harden, or dry the fuel accordingly. If the peat or lignite is used in its natural state for this purpose, it is not practical to obtain more than 25 per cent. of the total value of the fuel owing to its varying composition; methods under which it is burnt; and large percentage of moisture which absorbs considerable heat in its expulsion as a vapor.

Water Gas.

The use of water-gas (H_2+CO) appears to be particularly suitable for this purpose, and compares favorably with other forms of solid fuel from an economic standpoint. It has a further advantage in that its combustion can be kept under perfect control, and enable the desired temperature conditions of successful briquetting to be maintained at all times.

The generation of water gas is effected by passing steam through incandescent carbon according to the reaction $C+H_2O = H_2 + CO$, and the yield of gas per pound of carbon with efficient apparatus is 40 cubic feet with a calorific value of 305 B. TH. U. per cubic foot; or 12.200 B. T.H. U. per pound of carbon. The process consists briefly of heating the bed of fuel to incandescence by an air-blast at a pressure of from 10 inches of water to 3 pounds according to the size of the machine, and in the path of the air blast gases a tubular boiler is located for the generation of steam used in the water gas reaction and blasting machinery associated with the operation. The volume of air can be regulated at all times for complete combustion of the carbon in the gas generator or around the steam boiler, owing to the fact that the process is carried out under air and steam pressure and that the apparatus is operated to accurately timed periods of blasting.

In the employment of water gas apparatus for heating purposes in the briquetting of lignite or peat, it is obvious that gas can be generated equivalent to 12.200 B. TH. U. per pound of carbon used, and still evolve sufficient heat from the waste blast gases to evaporate the moisture from the aforesaid fuels previous to treatment for briquettting. The water gas apparatus is chiefly used in United States and Canada a a base for oil gas in the enrichment of gases obtained from the carbonization of coal or manufacture of coke. A water gas generator in combination with an oil carburetter is know as a "Carburetted Water Gas Set," and is used by nearly all manufacturing gas companies. The straight or blue water gas apparatus, however, is used for various industrial purposes, particularly in England and other European countries, and the fuel employed is either coke or hard coal. The water gas reaction however can be obtained from any substance containing carbon, and the lowest grade fuels can be used owing to the fact that combustion is caused to take place very vigorously by the employment of air under high pressures. On considering the fact that all organic matter contains an abundance of carbon, and that the supply of such matter is unlimited in districts where peat or lignite is found, the conversion of this matter into water gas appears to be the most economical. The heating value of lignite and peat is approximately 37.000 B. TH. U. per pound, but when consumed in its natural state it is only possible to obtain about 25 per cent. of the total value owing to irregularities.

The apparatus employed for the generation of water gas has been automatically operated with remarkable success, and can be shut down and started at a few minutes notice, so that little storage is needed when the gas is used immediately for heating purposes.

CHEMICAL SOCIETY NEWS

On January 23rd, one of the largest meetings ever held by the Local Branch of the Society of Chemical Industry took place at the Engineers' Club. Dr. A. B. Macallum gave an address, reviewing the work taken up by the Advisory Research Council to date. That portion of the address descriptive of the proposed Central Research Institute is given elsewhere. It was announced before the address that a series of interim meetings would be held devoted to special industrial groups. The first will be in charge of Mr. Heuter, of the Dunlop Tire and Rubber Co.

In his address, Dr. Macallum pointed out that the only real way to meet our great war debt was through stimulating our industries along scientific lines. Mr. S. J. McKinnon and Mr. S. R. Parsons, both in close touch with the Canadian Manufacturers' Association, were present, and spoke. Mr. John Morrison, representing the United Farmers' Association, endorsed the work as outlined by Dr. Macallum. During the general discussion following the meeting it was suggested that organized efforts be made by the Research Council and the Society of Chemical Industry to stimulate intelligent interest in this work on the part of manufacturers, directors of labor, and the public generally, through the technical and daily press. Through education, labor problems would be diminished, and through research competition could be met.

Ottawa—The Ottawa Branch of the Society established a precedent on January the 9th, when the members were entertained by an evening's pleasant and instructive exhibition of motion pictures showing something of the development of power that has taken place at Shawinigan Falls. Dr Shutt opened the meeting with a few explanatory remarks in which he commented on the turn to pictures which the Society has taken and which he was sure from the large attendance met with the approval of the members generally. He then introduced Mr. Labelle, the Power Sales Manager of the Shawinigan Water and Power Com-

pany through whose courtesy the films were obtained. Mr. Labelle traced the growth of power development at Shawinigan from its inception to the present and outlined some of the possible future work that remains yet to be carried out. The films were then shown and proved quite up to the expectations of the audience. Following these films, another series showing the possibilities of Winnipeg River Power were shown, and the programme was completed by a Chester-Outing film entitled "Unblazed Trails." This last one was taken in Banff Park and was scenically the finest shown. At the conclusion of the exhibition Dr. Shutt expressed the delight of the audience at the pictures which had been shown them, and extended the thanks of the Socitey to those through whose co-operation the show had been made possible. To Mr. Norrish, the efficient head of the Exhibits and Publicity Branch in whose projection room the pictures were shown, and by whom the last two films were loaned, the Society was particularly indebted. Next month the Ottawa Branch hope to have another evening of pictures, the feature of which will be the "Fixation of Atmospheric Nitrogen."

On January 23, Mr. J. Keele addressed the members of the Ottawa Branch on the Clay Product Industries of Canada." Mr. Keele is in charge of the ceramics department of the Mines Branch, Department of Mines, Ottawa.

INDUSTRIAL NEWS.

C. V. Corless, Canadian Manager of the Mond Nickel Company, has returned recently from London where he had been called for conference with English directors. An enlarged policy is about to be taken and it is proposed to nearly double the capacity of the Mond Company at Coniston, Ont., by establishing three new furnaces during the next few years.

The Dominion Foundries and Steel Company of Hamilton is about to enter on a period of peace production on an even larger scale that it operated on war work. They have under contemplation the installation of a plate mill with a capacity of 10,000 to 12,000 per month. When this is completed they will have a larger tonnage than was the case when under maximum war production. The plant already has a capacity of 1,500 tons for plates up to 24 in. in width.

A recent announcement has been made of the absorption of the Oliver Chilled Plow Co., by the International Harvester Company of Canada, Ltd., Hamilton.

Under Order-in-Council dated January 4th, 1919, the name of "Standard Chemical Iron and Lumber Company of Canada, Limited," has been changed to that of "Standard Chemical Company, Limited."

The Mond Nickel Company, whose mines are in the Sudbury district and smelting works at Coniston, Ont., is making a bond issue of £1,520,000 in London, England. The firm states that this capital is required for the extension of its works, made necessary by increased business.

The Canada Paper Co., Ltd., of Windsor Mills, Que., have purchased about 200 square miles of timber limit on the Ste. Anne River, formerly owned by Messrs. Power and Calvin. There is a very large quantity of white pine and spruce on the property, which will ensure the Paper Company a practically unlimited supply of pulp wood. The general manager of the company is Mr. F. J. Campbell, who is also president of the Canadian Pulp and Paper Association.

The Kipawa Fibre Co., Ltd., are erecting a sulphite mill and power house at Temiskaming, P. Q., at a cost of $3,106,000. Mr. C. B. Thorne is the manufacturing manager, and the contract has been awarded to Geo. A. Fuller Co., Ltd., Montreal.

The Belgo-Canadian Pulp and Paper Co., Shawinigan Falls, Que., suffered a heavy loss by fire on January 3rd, the damage being estimated at $100,000, which is, however, covered by insurance. Some fifteen cars loaded with pulp and paper were destroyed, along with other property belonging to the firm.

Price Bros., & Co., Ltd., 56 St. Peter St., Quebec, intend erecting a pulp mill at a cost of $1,000,000.

McArthur, Irwin, Ltd., have been appointed distributors to the Canadian Trade for Acetic Acid manufactured by the Canadian Electro Products, Ltd., of Shawinigan Falls.

The process of manufacturing acetic acid synthetically from acetylene gas, established at Shawinigan Falls, is described in this issue.

Canada produces about one-third of the total world supply of molybdenum and the requirements of this product under peace conditions cannot well be estimated. Further research may step in and show new uses. Until this has been done it would not seem advisable to open further deposits in the Dominion.

The removal of restrictions on imports is gradually winding up the business of the Canadian War Mission at Washington. Sir Charles Gordon, who was chairman of the British Mission will take over the Canadian work. Two members, R. H. McMaster and A. H. Scott, both of Montreal, have returned.

An explosion occurred recently in one of the smaller powder houses of the plant of the Canadian Western Fuel Company, Nanaimo, B. C., causing complete oblietration of the building. The cause of the accident is unknown. Western Fuel Company, Nanaimo, B. C., causing complete obliteration of the building. The cause of the accident is unknown.

The Dominion Government has decided that the deposits of platinum-bearing minerals in British Columbia are of sufficient value to warrant industrial development.

American copper interests are well united for export purposes. The Copper Export Association, Inc., whose present offices are with Anaconda Copper Co., New York, represent all the producers and each has voting privileges according to production during the year. Sixty per cent. of total American production will be exported. Great Britain will take 200,000 tons and France 145,000 tons.

A concentrator for the seperation of zinc from silver-lead ore has been installed at the Queen Bess mine near Kamloops, B. C., this mine was located in 1895, but was dormant until two years ago when it was brought into activity by the high price of zinc. Several other properties in the Kamloops district are now under option; the most important of these is the Old Homestake, a silver-lead mine, controlled and operated by the La Rose Co., of Cobalt, Ont.; the Lydia, a copper mine is bonded; the Polar Bear, a silver-lead proposition, bonded by the Noble interests of Kamloops, B. C., to an Idaho company.

Copper outcroppings in the Indian River-Howe Sound district are reported to be showing high values, these ore occurances are being worked by the Britannia Mining Co., of B. C.

The Meteor Mine, a silver proposition at Slocan City, B. C. has recently changed ownership, the development is under the management of W. A. Buchanan, this mine ships most of its ore to Trail, B. C.

Attention has lately been attracted to the Salmon River District owing to the reopening and development of the old Bush Mine.

It is reported that thorough examination of the native copper deposits is to be made on the shores of the Arctic Ocean adjacent to the Copper Mine River and Bathurst Inlet.

The announcemnnt is made by the International Food Products Ltd., Vancouver, of the erection of the first unit of a plant at Industrial Island, Vancouver, B. C., for the manufacture of all kinds of vegetable oils. This concern proposes to manufacture linseed oil from flax grown on the Canadian Prairies as one of its first products.

The following new coal mines are being worked;—the Cassidy belonging to the Granby Company; No. 5 South Wellington of the Canadian Colleries; the Farm of the Canadian Western Fuel Co.; the Telkwa; and the Coalmont at Princeton, B. C., the opening of these new mines should materially assist the smelting industry during the present readjustment period.

The Dominion Government exploration work recently done in British Columbia shows that platinum can be produced in paying quantities from the auriferous gravels of Tulameen, Cariboo and Fraser Rivers.

The following companies have been incorporated lately in British Columbia;—

Couverapee Mining Co., Ltd., Field, B. C. Capital $1,000.00.

Whitmarsh Mining and Development Co., Ltd., (N.P.L.), Quesnel Forks. Capital, $1,000.000.

Hemphill's Trades Schools, Vancouver. Capital, $20,000. Technical and Industrial School.

Moody Rolling Mills, Ltd., 602-606 Pacific Bldg., Vancouver, Capital $20,000; to establish steel rolling mills at Port Moody, B. C.

The Silver Peak Mining Co., Ltd., (N.P.L.), 584 Richards St., Vancouver, Capital $10,000, mining development.

Th chief storehouse of the British Chemical Co., Trenton, Ont., was destroyed, with all its contents, on the night of January 29th. The loss is estimated at over $175,000. Cause of fire unknown.

Roy M. Conger, of New York, a nephew of the U.S. Minister to China, has bought from the Imperial Munitions Board, through Sir Joseph Flavelle, the aircraft equipment in Canada, which cost $1,000,000. This refers to the air machines, engines and parts and camp equipment but does not include the airplane manufacturing plant in Toronto.

At a meeting of the Belleville Club, on the 28th Jan., Mr. J. W. Evans, of the Tivani Electric Steel Co., of that city, urged that the Dominion Government should appropriate a fund of a million dollars for testing the iron and other ores, to determine their economic value, and that $75,000 should be applied to experimental work in Hastings County, which has such a variety of minerals, besides the large iron ore deposits. Mr. Joseph James endorsed the proposal, and pointed out the great advantages Hastings County has in its undeveloped water powers.

The large chemical plant of the British Chemical Co., at Trenton, Ont., will be sold on the 27th February. Particulars are given on page 1 of the advertisement section of this issue.

The British Trade Commissioners in Canada (Mr. G. T. Milne, at Montreal, and Mr. F. W. Field, at Toronto), have received cable advices from the Department of Overseas Trade (Development and Intelligence) that the following wide range of British manufactures have been placed on the free list, and now require no export license:

Artists' materials, athletic goods, bicycles (but not tires), bicycle accessories (various), buttons (except military), horn and vegetable ivory, cigar and cigarette holders, china and earthenware, china clay, clocks, cutlery, drugs (various), fancy goods of paper, ivory, leather, etc.; films subject to censorship, flower seeds, fountain pens, furs (dressed, dyed or manufactured); glassware, hardware (iron and steel builders); hats, household effects of wood, iron or steel, ink, jewellery (imitation or pearl), laces, laundry machinery, ledgers, marble, mineral waters (unsweetened), musical instruments, office furniture, pictures, paintings, phonographs, photographic materials (not chemical), razors (safety and blades), ribbons (silk), spectacles, sewing machines, wallpaper.

Lists of goods for which export licenses are still required for shipment from the United Kingdom will shortly be in the hands of the British Trade Commissioners noted above. They will also be advised weekly, by cable, by their department in London of the goods removed from such lists and any alterations thereto.

The British Trade Commissioners will be glad to take up these matters with local importers and others interested.

The following are some of the principal commodities for which licenses are still required:

Abrasives, agricultural machinery, cement, chemicals (various), coal and coke, oils, pipes (cast iron), packing cases, railway material, resins, coal tar products, copper (wrought and unwrought, including wire); alloys, dyes, foodstuffs, food for livestock, glue, iron angles, bars, billets and constructional material, steel angles, ingot plates and similar raw materials, textile machinery, textile yarns, fibres and waste; tin plates, war material, wire rope, wood and timber.

The prohibition of the exportation of raw materials does not extend to goods manufactured from such materials.

PERSONAL.

Having received an honorable discharge from the Chemical Warfare Service of the U.S.A., Mr. Edward A. Dare has accepted a position with the Great Northern Paper Co. at Millinocket, Me. Mr. Dare was formerly chief chemist at the Bathurst Lumber Co., Bathurst, N.B.

It is reported that Prof. J. C. McLennan, Ph.D., F.R.S., formerly director of the Department of Physics and Physical Laboratories at the University of Toronto, and more recently in charge of War Research Work in England, has been offered the post of Superintendent of Scientific Research and Experiment for the British Admiralty.

Mr. L. B. Beale, Lumber Commissioner of the British Columbia Government, has been appointed British Trade Commissioner in Western Canada, with the territory from Winnipeg to the Pacific Coast under his jurisdiction. The new Trade Commissioner will probably be stationed at Winnipeg.

Mr. C. H. Speer, of the Algoma Steel Corporation, Sault Ste. Marie, Ont., has been actively engaged in the organization of night classes for workers in the industries of Sault Ste. Marie, especially employees of paper mills and steel mills.

Mr. Charles F. Roth, joint manager with Mr. Fred W. Payne of the National Exposition of Chemical Industries, has received his discharge from the chemical department

of the United States War Service, and we understand will again devote himself to the interests of the Exposition. As our readers are already aware, the National Exposition will be held in Chicago, but the executive offices will remain for some time at 405 Lexington Ave., New York.

A. Papineau Couture has recently accepted a position as chemist with the Riordon Pulp and Paper Company, Merritton, Ont. Mr. Couture was formerly with the Abitibi Pulp and Paper Company, Iroquois Falls, and more recently with the Canadian Explosives, Limited, in their research laboratory at Beloeil, Que.

Hoyes Lloyd, M.A., who for the past six years and a half has had charge of the milk work in the Laboratories Division of the Department of Public Health, Toronto, has stepped out of chemical work to follow more closely his particular hobby—Birds. He has accepted a position as Ornithologist in the Dominion Parks Branch of the Department of the Interior at Ottawa and took up his new duties last month. He has charge of the administration of the Migratory Birds Convention Act which is the Canadian end of an international agreement between Canada and the United States for the preservation of all our migratory birds. It is interesting to note that this is the first international agreement of its kind in the world and that the Canadian Act was at least a year in advance of the United States at that, so that Canada may be said to lead the world in this regard.

RECENT INCORPORATIONS.

Vancouver.—Pacific Sheet Metal Works, Ltd., 523 Seventh Ave. W. Capital, $50,000. Sheet metal works, stoves and furnace manufacturers.

Victoria.—International Coal Co., Ltd., Law Chambers. Capital, $50,000. Coal mining.

Vancouver.—Alberni Packing Co., Ltd., 744 Hastings St. W. Capital, $20,000. Fish curing and packing.

Toronto.—Lamson & Hubbard Canadian Co., Ltd. Arthur Lorne Reid, solicitor. Capital, $325,000. Tanners, dyers.

Calgary.—United Oils, Limited. Austin de Bernus Winter, solicitor. Capital, $350,000. Oils, gas, minerals.

Quebec.—Valcartier Lumber & Pulp Co., Ltd. Chas. Edmond Taschereau, solicitor. Capital, $150,000. Pulpwood, timber, pulp.

Montreal.—International Clycerine Co., Ltd. Gerald Augustine Coughlin, solicitor. Capital, $100,000. Chemicals research and engineering work.

Ottawa.—Murphy Victory Furnace Co., Ltd. Andrew Haydon, solicitor. Capital, $500,000. Furnaces, Bessemer converters, electric furnaces, foundry supplies.

Quebec.—Asbestos Manufacturing Co. Chas. Edmond Taschereau, solicitor. Capital, $1,000,000. Ores, minerals, machinery, clay products.

Toronto.—Canada Wyoming Refining, Ltd. Wm. Alfred J. Case, solicitor. Capital, $2,000,000. Oil, gas, salt, minerals, metals, ores, chemicals.

Hamilton.—MacPherson Manufacturing Co., Ltd. John Alex. MacPherson, manufacturer. Capital, $50,000. Iron, steel, annealers.

Hamilton.—The Ford-Smith Machine Co., Ltd. Archibald Hope Gibson, solicitor. Capital, $500,000. Iron and brass founders, metallurgists, chemicals, dyes, minerals.

Toronto.—Brass and Metal Products, Ltd. John Clark Thomson, solicitor. Capital, $300,000. Ores, metals, minerals.

E. M. McDougall, Montreal, solicitor. Capital, $500,000. Rubber, felt.

Winnipeg.—Dominion Rubber System (aMnitoba), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $500,000. Rubber, felt.

St. John.—Dominion Rubber System (Maritime), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $500,000. Rubber, felt.

Toronto.—Dominion Rubber System (Ontario), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $1,000,000. Rubber, felt.

Vancouver.—Dominion Rubber System (Pacific), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $250,000. Rubber, felt.

Montreal.—Dominion Rubber System (Quebec), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $1,000,000. Rubber, felt.

Regina.—Dominion Rubber System (Saskatchewan), Ltd. E. M. McDougall, Montreal, solicitor. Capital, $500,000. Rubber, felt.

Toronto.—Turnbull Elevator Company Ltd. John Harvey Turnbull, manufacturer. Capital, $500,000. Iron, steel, brass founders; wood alcohol; dyes; fertilizers; ores, metals, minerals and oils.

Hamilton.—Petrie Mfg. Co., Ltd. Alex. Bain Petrie, Sr. Capital, $2,000,000. Iron, wood fibre, metal, clay.

Toronto.—English Electric Company, Ltd. James Steller Lovell, accountant. Capital, $500,000. Electrical and mechanical engineers; construct chemical works and laboratories.

Montreal.—British Refractories Corporation, Ltd. Louis Athanase David, solicitor. Capital, $750,000. Ores, metals, minerals, smelting and refining.

Montreal.—G. & J. Esplin, Ltd. Jacob DeWitt, Outremont, solicitor. Capital, $400,000. Pulpwood, paper, ores, minerals and metals.

Toronto.—Mabee Condensed Milk Co., Ltd. Andrew Wentworth Hunter, solicitor. Capital, $1,500,000. Chemical manufacturers and analysts, condensed and evaporated milk manufacturers.

Hamilton—John E. Riddell & Son, Ltd. James Chisholm, solicitor. Capital, $100,000. Metals, minerals, paints, varnishes, chemicals, gas.

Montreal—American Druggists Syndicate, Ltd. Walter R. L. Shanks, solicitor. Capital, $25,000. Oils, paints, chemicals and chemical apparatus.

Montreal—Kipawa Company, Ltd. Gordon Walters MacDougall, K.C., solicitor. Capital, $20,000,000. Pulp, peat, alcohol, chemicals, minerals and metals.

Montreal—Canadian Potteries, Ltd. John MacNaughton, solicitor. Capital, $500,000. Clay products, chemical porcelain, minerals, chemicals.

Montreal.—Dominion Rubber System, Ltd. Errol Malcolm McDougall, solicitor. Capital, $500,000. Rubber, felt.

Calgary.—Dominion Rubber System (Alberta), Ltd.

Montreal—Adenac Producing Co., Ltd. Joseph Horace Michaud, solicitor. Capital, $300,000. Conducting scientific and research works and explorations.

Hamilton—The Smart-Turner Company, Limited. James Chisholm, solicitor. Capital, $200,000. Steel barrels, oils, paints, minerals, oils, metals, chemicals.

Montreal—T. G. McLaurin Co., Ltd. Eratus E. Howard, K.C., solicitor. Capital, $20,000. Pulp wood, oil, coal-tar.

Montreal—John W. Gates, Ltd. Charles Holdstock, Journalist. Capital, $49,000. Minerals, ores, chemicals.

RECENT CHEMICAL AND METALLURGICAL PATENTS.

Reported to the Canadian Chemical Journal by A. E. McRae, Ottawa.

Separating Nitro Compounds from Liquid, F. M. G. Johnson, Can. 187,937, Dec. 17, 1918. The acids are confined at pressures below atms until the nitro-particles are floated to the surface by accumulation of gas on the particles. The cleared acid is drawn off from beneath the floating mass, which is finally heated to melt the nitro-compounds and cause complete separation from the remaining acid.

Bearing Metals, W. H. Kelly, Can. 187,991, Dec. 24, 1918. Bearing metals of Pb and Cu are made by first purifying the Pb by subjecting it, while in a molten condition, to the action of H and O, then mixing the Pb with pure Cu.

Process of Making Ferro Silicon, G. C. Furness, Can. 188,023, Dec. 24, 1918. A charge, comprising SiO_2, a reducing agent high in fixed C, a source of Fe and bituminous coal in proportion, to supply upward of 10 per cent. of the fixed C requirements of the reaction is smelted in an electric furnace between deeply embedded electrodes.

Briquets and Method of Making Same, C. H. Smith, Can. 187,952, Dec. 17, 1918. A smokeless briquet having many of the valuable properties of anthracite coal is made by distilling from coal at a low temperature a substantial portion of the volatile matter, pulverizing the partially carbonized residue and mixing it with a suitable binder, then forming the mixture into briquets, which are heated at a higher temperature to distil off most of the volatile portion. The briquets are then allowed to cool.

Extracting Iodine and Other Chemical Products from Seaweeds by Dry Distillation, J. A. W. Bredenberg, Can. 187,721, Dec. 3, 1918. Iodine or like products are extracted from seaweed by dry distillation in a closed retort. The gases are passed through a condenser and the uncondensed gases are passed through a metal salt, which will absorb the volatile Iodine and Br. The residue in the retort is soaked with water and the dissolved salts are separated.

Process of Recovering Zinc, F. Laist, Can. 187,772, Dec. 3, 1918. Calcine is leached with an acid liquor, the liquor is neutralized to ppt. the silica in the presence of an insoluble residue, which is then separated from the zinc-bearing solution, the residue is re-pulped with water, the dilute zinc-bearing solution is removed, and the zinc is separately recovered from the two zinc-bearing solutions.

Process of recovering zinc, F. Laist, Can. 187,773, Dec. 3, 1918. A silicious calcine is leached with an acid liquor, the silica is prepared in gelatinous form by neutralizing the liquor, the zinc-bearing solution is separated from the residue, which is dehydrated and the zinc is recovered by leaching in acid solution.

Production of Cyanogen Compounds, A. R. Lindblad, Can. 187,728, Dec. 3, 1918. An alkali silicate, with a reducing agent, and lime is charged into an electric furnace in the presence of N, and heated to form cyanogen compounds which are removed from the furnace.

Refining of Volatile Metals, S. Huldt, Can. 187,864, Dec. 10, 1918. Metal to be refined is fed in an electric arc furnace through a liquid trap formed by said metal, so as to maintain a metal bath in the furnace bottom, the surface of the bath is exposed to heat from the arc and the metal vapors are removed and condensed.

Process for the Sulfonation of Aromatic Hydrocarbons or their Derivatives, Bull, H., Can. 187,834, Dec. 10, 1918. The substance to be sulfonated and H_2SO_4 are caused to react on each other in the presence of a solvent, in which the said substance and the sulfonated product are soluble, but the H_2SO_4 is not appreciably soluble, and the product extracted in the solvent is withdrawn.

FOREIGN TRADE ENQUIRIES.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the number of the enquiry. The initials, "B.T.C.," indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

926—Molybdenum concentrates. A Sheffield manufacturer of carbonless metals and alloys wishes to get into touch with shippers of the above with a view to future purchases.

930—A London company wishes to get into touch with Canadian manufacturers with the object of securing their selling or buying agency for the United Kingdom. They have a branch at Birmingham. Goods suggested are steel and copper wire, wire nails, etc., mica, chemicals, leather for upholstering trades, wood-pulp, etc.

931—A firm in Amsterdam, Holland, desires the addresses of Canadian manufacturers of crude asbestos.

932—Cellulose, chemicals and metals, boots and shoes, food products. An import-export house in Milan wishes to hear from Canadian exporters of the foregoing products.

934—A firm in Milan wishes to get in touch with Canadian firms with a view to obtaining exclusive agencies in Italy for industrial chemicals, metallurgical products and metals and refractory material.

974—Linseed cakes. A Liverpool firm ask to be placed in communication with exporters of linseed cakes.

976—A Newcastle firm in a position to place orders for asbestor fibre in 50- to 100-ton lots, ask for Canadian offers. They also inquire for asbestos cell and asbestos cloth.

18—Carbon black. A Glasgow firm who have been importing the above from the United States wish to hear from Canadian exporters.

20—Asbestos, engine and pump packing, India-rubber rubber goods, engineers' machines and tools. A Glasgow firm making a specialty of supplying engineers' and public works requirements in the engineering line, are open to consider representation of manufacturers of the above, either as purchasers or sole agents.

30—A South African sales agent covering all centres of South Africa twice a year is prepared to take up a Canadian paint and varnish agency, also white lead and linseed oil.

38—A British firm of manufacturers' representatives with headquarters in London and arrangements for the marketing of goods throughout the United Kingdom, wishes to get in touch with Canadian manufacturers of the following articles with a view to representing them as sole agents either on a commission or buying basis: Malleable iron steam fittings, electric plant and equipment for all purposes including shipbuilding, brass fittings, pumps, forgings, stampings, machine tools, etc., tools of all kinds, wood manufacturers, chemicals, household laundry machinery, toys, metal fittings for fancy goods.

44—Asbestos. A French commission house would like to get in touch with Canadian exporters of asbestos.

60—Formaldehyde. A Leeds firm wishes to get into touch with exporters of 40 per cent. formaldehyde.

BOOK REVIEWS.

Electrometallurgy. Eric K. Rideal. Bailliere, Tindall & Cox, London, England, pp. 247.

One could hardly suggest a topic more timely or more interesting to a large number of Canadian metallurgical and chemical engineers than the general subject—Electrometallurgy. This book is but one of a series brought out recently to fill the demand for applied industrial literature. Already the industries discussed have in some form been established in Canada. For students looking forward to work of this nature, the book should be a moderate inspiration. For business men who have not had the training of the electrochemical engineer, and who are interested in financing developments along these lines the work offers concise, clear and very informing data. For the general metallurgical engineer who has not made a special study of this field much valuable matter is collected and chemical theory given.

The contents are divided into sections which are quite well illustrated and each section is followed by a very fair collection of special references to original literature.

Introduction: Devoted to general theory, the value of power from various sources and some data on the metalliferous resources of the British Empire.

Section 1: Electrolysis in aqueous solutions. About one-third of the book is given over to a very full comparative discussion of recent practices in the electrolytic treatment of copper, nickel, cobalt, silver, lead, antimony, cadmium, tin and bismuth. Special metal combinations are considered.

Section 2. Electrolysis in Fused Electrolytes. Problems and methods of working with sodium, potassium, magnesium, calcium, strontium, barium, lead, zinc and aluminum alloys are discussed.

Section 3: Electrolytic preparation of the rarer metals.

Section 4: Electrothermal Processes. Comparative furnace designs are given and specific treatment of various metals outlined. Manufacture of graphite, phosphorus, arsenic and carbon disulphide is described.

Section 5: Carborundum and Oxysilicides of Carbon. The manufacture of well-known products is discussed.

Section 6: The Carbides.

Section 7: Electrothermal Nitrogen Fixation by Metals and Metallic Compounds. The whole nitrogen problem is discussed.

Section 8: Iron and Ferro-alloys. A most interesting chapter on electrolytic iron, manufacture of steel, furnace designs, and the general production of ferro-alloys.

The author deserves much credit for bringing together such a wealth of matter from papers many of which have appeared such a short time ago. The general demand at present existing for such information should warrant a large circulation of this edition in Canada, as the industries treated should find some of their best opportunities for development in this country. Price 7s 6d net.

Davison's Blue Book of the United States and Canada is now a standard work, and the 31st annual edition revised up to July of last year maintains the well-established reputation of the publishers. It comprises a complete directory of the cotton mills, woollen mills, silk mills, jute, flax, etc., the knitting mills using cotton, wool or silk yarns, with lists of the dyers and dealers in raw textile materials. The new edition contains over 1300 closely printed lists, with maps and index of each department. The publishers have a fair show of reason in designating this book to be "21 directories in one volume." The office edition is published at $5.00, and the salesmen's edition at $3.00—the latter containing the lists of mills only. Published by the Davison Publishing Company of 50 Union Square, New York.

Recent Technical Reports, Bureau of Mines, Washington.

(1) An absorption Method for the Determination of Gasoline in Natural Gas. W. P. Dykema and R. O. Heal. The test absorber and method described are recommended in preference to the use of scrubbers because they give more significant results when evaluating a gas before installing an absorption gasoline plant.

(2) Innovations in the Metallurgy of Lead. D. A. Lyon and O. C. Ralston, pp. 162. An account is given of investigations during years 1914-16 at the Salt Lake City Station, Bureau of Mines, Utah. Methods for treating lead carbonate and complex sulphide ores are discussed with details of research work undertaken.

(3) Extinguishing and Preventing Oil and Gas Fires. C. P. Bowie, pp. 50. The experience of practical men who have fought large oil fires is recorded and certain apparatus shown specially designed for such work.

(4) Eighth Annual Report of Director Bureau of Mines for the year ending June 30, 1918. The military work done during this period makes the report of special value.

(5) Methods of shutting off water in oil and gas wells. F. B. Tough, pp. 118.

(6) Rock Quarrying for Cement Manufacturers. O. Bowles, pp. 160.

(7) The Fusibility of Coal Ash and the Determination of the Softening Temperature. A. C. Fieldner, A. E. Hall, and A. L. Field, pp. 145. A practical method of determining fusibility has been developed whereby the ash is caused to soften and form slags in which the iron exists in approximately the same state of oxidation as the iron in fuel-bed clinkers.

(8) Melting Brass in a Rocking Electric Furnace. H. W. Gillett and A. E. Rhoades, pp. 131. The possibilities and limitations of a rocking electric brass furnace are set forth in detail. The general problem of electric brass furnaces is discussed.

(9) Economic Operation of Steam Turbo-Electric Stations. C. T. Hirshfield and C. L. Kerr. pp. 29.

(10) Method of Least Squares applied to Estimating Errors in Coal Analysis. J. D. Davis and J. G. Fairchild. pp. 36.

(11) Sulphur Dioxide Method for Determining Copper Minerals in Partly Oxidized Ores. C. E. Von Borneveld and E. S. Leaver. pp. 14.

(12) California Mining Statutes, Annotated. J. W. Thompson. Law Series 13, 1918. pp. 312.

United States Tariff Commission.

(1) Census of Dyes and Coal-Tar Chemicals, 1917.

(2) Dyes and Other Coal-Tar Chemicals. A report to Congress recommending amendments to present United States Tariff Laws of 1916.

Power, Its Significance and Needs. C. J. Gilbert and J. E. Pogue. Bulletin 102, part 5. Smithsonian Institution, United States National Museum. pp. 531.

Natural Gas. Its Production, Service and Conservation. S. S. Wyer, United States National Museum Bulletin 102. part 7. pp. 65.

Chemical, Drug and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

The iron and steel markets are beginning to lose some of the momentum which carried them up to the end of the year. The mills in the United States are producing at about 60 per cent. of their capacity. This, however, would still make a large normal tonnage. Recent efforts have been made, originating from Port Arthur, to have the Government bonus production of iron and steel at the Canadian head of Lake Superior. It is claimed that, with but slight assistance, large bodies of Canadian ore could be utilized in these districts and could compete in Western trade. The automobile trades are creating the heaviest steel demands at the present moment. The Dominion Government has already contracted for several hundred cars for the Canadian National Railways. Ocean rates have been reduced, and as more space becomes available, it is expected, with the opening of the season, that commercial traffic will be running freely after further reductions. Many of the non-ferrous metals are likely to reach a rough peace basis fairly rapidly. Antimony, copper, tungsten, zinc, lead, and tin, are either not active or are declining. Power troubles were disturbing the Niagara district again, but an adjustment is promised by distributing a new block of 50,000 horsepower. The mining camps of Ontario and B.C. are quite active and are taking on men. During the year increased production in silver and gold may be expected. With the extension of railway facilities in Northern Ontario large ore bodies may be successfully worked. Construction work is under way on the new nitrogen fixation plant of the American Nitrogen Products Co., at Lake Buntzen, B.C. A new cyanide mill will be erected on gold property at Skidegate, B.C., while the Steel Co. of Canada are building a benzol plant in connection with their coke ovens at Hamilton, Ont. Promised construction and development work in mining, metallurgy, pulp and paper, should greatly swell the volume of business done in these lines during the year.

The putting into operation of the new Soda Ash Plant of the Brunner, Mond, Canada, Ltd., at Amherstburg, has created a new industry for Canada, which will be welcomed by Canadian manufacturers.

The general feeling is that during the next few years Canada should become an exporter of light and heavy oils. Importations now amount to $5,000,000 per year. Capital is again considering the opening up of oil shales in New Brunswick, while in Alberta several recent strikes have been made, especially in the Peace River District. Seven new outfits will operate here during the spring. In Middlesex County, Ont., drilling operations have been stimulated by recent operations in Mosa Township. Districts between London and St. Mary's have been leased, and there is no reason why the real development of Canadian oil resources should be further delayed. Importations of potash, affecting the fertilizer industry, are likely to be delayed longer than was at first expected. France announces that no potash will be exported during this year. It will thus be probably two years before any large quantity of European potash reaches Canadian consumers.

It is announced that McArthur, Irwin & Co., Montreal, have taken over the sales agency for acetic acid as manufactured at Shawinigan Falls. The extension of Canadian foreign trade in wood distillation products and synthetic organic chemicals of this type is expected. The production of industrial alcohol as a product from sulphite liquors is receiving every attention at the hands of the Government and certain pulp and paper companies. This is being backed up by the Canadian Manufacturers' Association, and the chief impetus to the movement comes from Montreal.

There are movements under way, expected to ultimately change the dye situation here. An amalgamation of Swiss interests is now certain. There is a further possibility that this will extend to co-operation with some British connection, as far as agency work in America is concerned.

In discussing general chemical market conditions one prominent dealer said, in reference to Canadian trade: "We have quit sending our lists of prices, but have informed our customers that we will take care of their requirements at market prices; in other words, we are meeting every situation as it arises, feeling confident that prices and other matters will eventually adjust themselves. However, the idea that the market is going to break badly is gone. This was the feeling for a few weeks after the armistice was signed, but people are now over that idea and are ordering more freely. Of course, we expect a gradual lowering of prices, but this process will be very gradual, and we do not look for any sudden break."

Another dealer declared that December and January were always dull months, and that the conditions of affairs this year was not very much worse than usual. According to this firm the most noticeable drop in prices was in connection with glycerine, this being due to the fact that explosive makers had ceased to operate, with the result that the demand of this commodity had fallen off. On the whole, chemical houses in Montreal and Toronto are confident regarding the future, and declare that the situation will eventually right itself.

Acetanilid, C. P.	Lb.	1.00
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	.24—.27
Aspirin	Lb.	2.60—2.75
Alcohol, grain, bbl.	Gal.	8.50
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.00
Ammonia, Aqua 26°	Lb.	.12—.14
Ammonium Carbonate	Lb.	.17—.18
Ammonium Chloride	Lb.	.25—.30
Benzoic Acid	Lb.	2.25
Bleaching Powder, 35% drums	Lb.	.03½—.04
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.16—16½
Calcium Chloride, fused	per ton	$30—$35
Carbolic Acid, white crystals	Lb.	.35—.45
Carbon tetrachloride, drums	Lb.	.22
Caustic Soda, ground, bbl.	Lb.	.05½—.06
Chloroform	Lb.	.65—.70
China Clay, imported	Per ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	.09½—.10
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.25
Hydrochloric Acid, carboys, 18°	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03½—.04
Nitric Acid, 36° carboys	100 Lbs.	.08¾—.09½
Naphthaline, flake	Lb.	.10—.13
Oxalic Acid	Lb.	.42—.45
Potassium Bromide	Lb.	.75
Potassium Nitrate, kegs	Lb.	.35—.40
Potassium Permanganate, bulk	Lb.	2.25—2.50
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	1.25—1.50
Soda Ash, bags	Lb.	.03½
Sodium Acetate	Lb.	.20—.22
Sodium Benzoate	Lb.	2.50—2.75
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00
Sodium Bichromate, bbls.	Lb.	.20—.22

(Continued on page 46)

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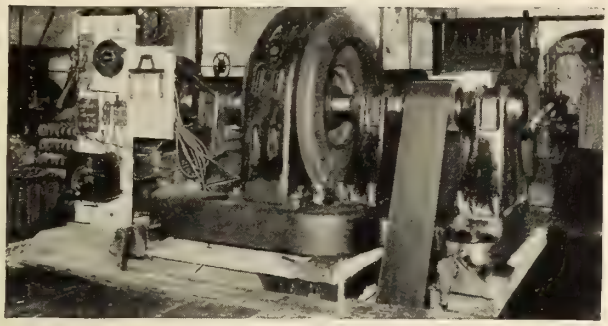

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Sodium Nitrate, refined	100 Lbs.	7.00—8.00
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.35—.40
Sodium Hyposulphite, kegs	100 Lbs.	4.00
Sodium Silicate, according to density	100 Lbs.	3.50—4.50
Sulphur, ground	100 Lbs.	3.00—3.25
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	2.50—2.70
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	.95—1.00
Tin Chloride, crystals	Lb.	.60
Zinc Sulphate, com.	Lb.	.06½

Metals.

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	.10
Brass, yellow ingots	Lb.	.16—.18
Brass, red	Lb.	.20—.23
Cobalt, metal	Lb.	2.50—3.50
Cobalt Oxide, grey	Lb.	1.65
Copper, casting	Lb.	.24
Copper, electrolytic	Lb.	.24
Iron, common, base price	100 Lbs.	5.00
Lead	Lb.	.08½
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure Government price	Oz.	105.00
Silver, bar (U.S. Govt. price)	Per troy oz.	1.01⅛
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	.75
Zinc, sheets	Lb.	.18—.20

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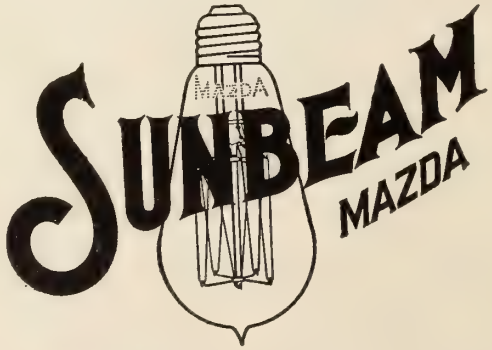

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November 26th, 1918.

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EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of THE CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

University graduate, B.Sc., with eight years' experience in chemical research, design and operation of organic, inorganic and electro-chemical plants, is open for engagements in any of the above capacities.—Box 35, Canadian Chemical Journal.

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Chemical Engineer, University graduate, 26 years of age, desires position with industrial firm, where opportunities for advancement exist. Exceptionally high references regarding ability and character. Ontario, Quebec, or States preferred. Apply Box 33, Canadian Chemical Journal.

Analytical chemist, University graduate, familiar with soap and glycerine manufacture, and with fats and oils industry, open for engagement, preferably in Eastern Ontario or Quebec. Capable of research work, and of managing plant. Highest recommendations. N. Mills, 78 Gloucester Street, Toronto.

Young chemist, recent graduate (B.Sc.) waits an opening either in industrial or teaching work. Experience in teaching and organic research. Would accept small salary if good chance of advancement. Best of references. Box 38 CANADIAN CHEMICAL JOURNAL.

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Young chemist, married, graduate from American College. Solid technical training; energetic and resourceful; experience in physiological chemistry; three years' experience in manufacturing of Synthetic phenol and Picric acid. Would like position in chemical research, laboratory or factory control. Box No. 37, Canadian Chemical Journal.

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BENZOATE OF SODA U.S.P.

BENZALDEHYDE, technical 95 per cent.
Aldehyde contents.

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Pfaudler Utility Pot

SPECIFICATIONS

Capacity—26 gallons.

Size—Diameter inner pot 18 inches. Depth inner pot 25 inches. Total height 45 inches with legs. Floor space 4 square feet.

Material—Open hearth sheet steel, three-sixteenths of an inch thick.

Lining—All interior surfaces in contact with contents lined with PFAUDLER Acid-Resistant, Glass Enamel.

Connections—One 2 inch standard flanged nozzle. Two 3 inch standard flanged nozzles. Jacket connections—1 inch oil inlet and 1 inch drain.

Handles—3 handles welded to inner pot to facilitate its removal.

Top Head—Secured to pot by 12 C-clamps. Joint made with asbestos gasket.

Jacket—Sealed with asbestos gasket and secured to inner pot with 12 bolts.

Legs—Three-eighths inch steel 2½ inches wide of suitable length.

What the Chief Chemist Said:

"It has proven invaluable in our work, both because it has given splendid satisfaction with acid solutions (Sulphuric, Nitric and Acetic in various concentrations), and because we have found it so handy and convenient for so many different operations. I do not see how any manufacturing chemist or pharmacist is content to get along without this compact, efficient, versatile, economical outfit."

This is what Dr. Schultz, chief chemist of the Rochester Photo-Chemical Works, says about the PFAUDLER, Acid Enameled, Utility Pot shown in the picture after over a year's experience with it.

He also told us (for publication) how he was able to use this outfit for Distilling, Evaporating, Crystalizing, Dissolving and Mixing and for carrying out various reactions requiring an absolutely acid-resistant container.

Inasmuch as the Rochester Photo-Chemical Works is a real synthetic chemical plant, where they build up exceedingly complex organic compounds from raw material, carrying out in the process many major chemical operations, such as electrolytic, synthetic condensation, their experience should be of deep interest to everyone interested in manufacturing chemistry.

We have published the Doctor's observations in the form of an attractive little folder entitled, "What the Chief Chemist Said," and will be glad to send a copy to any Chemist who will send us his name and address. This without any obligation whatsoever. Address the Rochester Office.

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Ontario abounds in waterpower, now in many places being transformed into hydro-electric energy for manufacturing, mining and metallurgical purposes. Many localities are capable of becoming industrial centres for the transformation of raw materials into finished products by electro-chemical and electro-metallurgical processes. A striking example is the area contiguous to the great cataract of Niagara.

For information in regard to ores, minerals and mineral products, and for reports, maps, list of publications, etc., apply to

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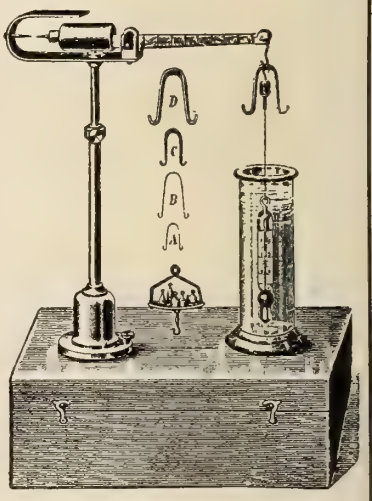

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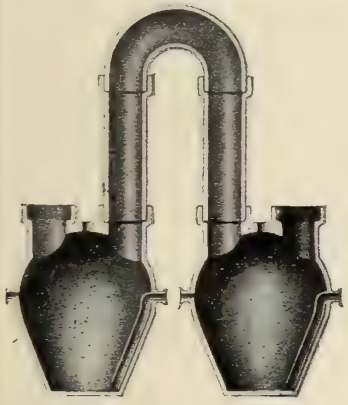

CHEMICAL STONEWARE

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Our stoneware is vitrified and covered with an acid proof glaze

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Canadian Branch of THE ROBINSON CLAY PRODUCT CO.

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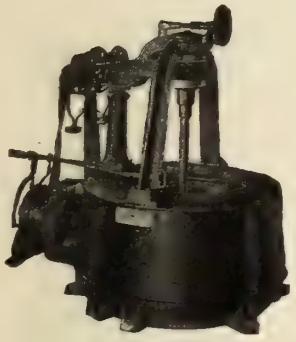

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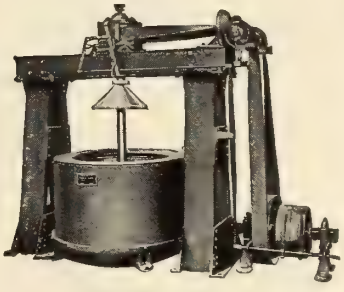

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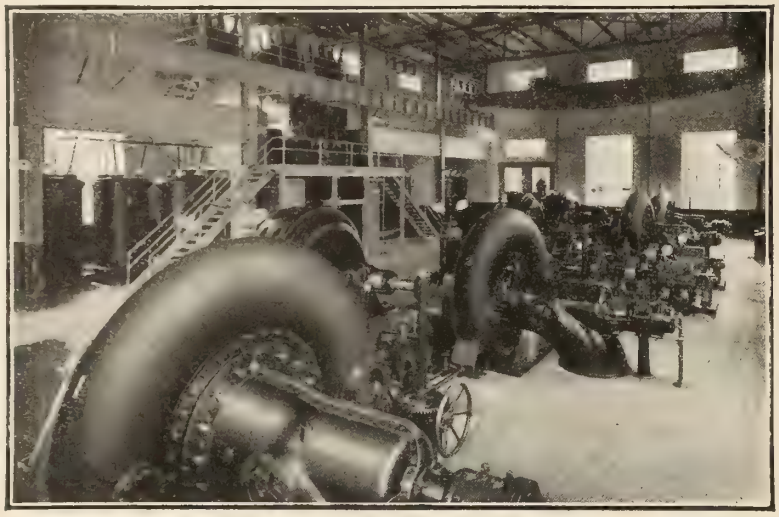

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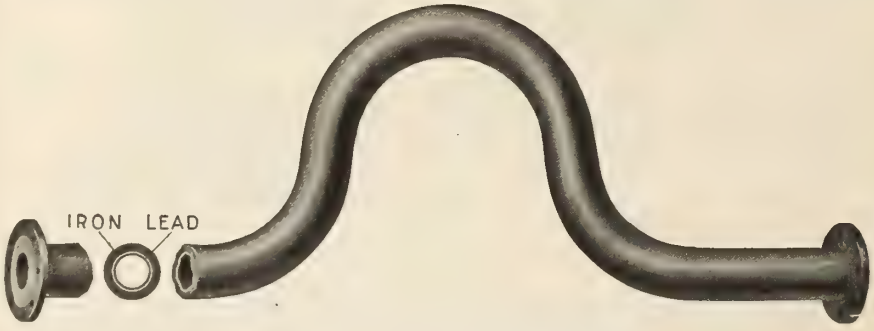

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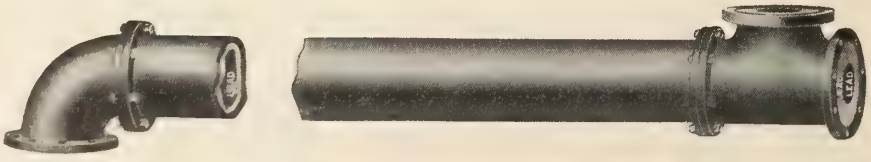

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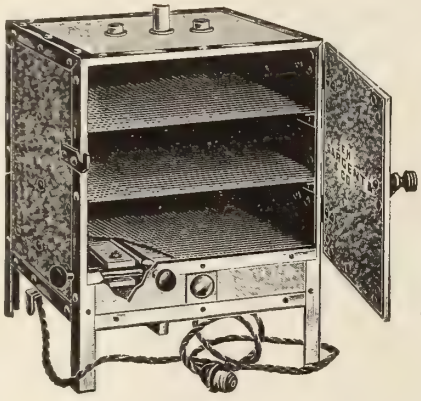
SARGENT'S ELECTRIC DRYING OVEN

With Automatic Temperature Control

(Patented, Jan. 6, 1914)



THIS is the pioneer of moderate-priced ovens in this class, and the hundreds now in satisfactory operation prove its success. This end has been achieved by ruggedness of construction, elegance of design and due observance of the scientific principles which are demanded in drying ovens.

The ventilation is ample and the cold air enters through the bottom and passes upward, being heated by the heating coils before reaching the sample. The heating units are of the simplest construction and may be rewound or replaced by the operator in two minutes. No lamps are needed for setting the control and thus all glass is eliminated.

Its extreme simplicity precludes the imitation of its patented features and enables it to maintain its position as the best and cheapest apparatus on the market for its purpose.

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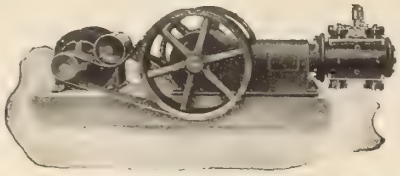

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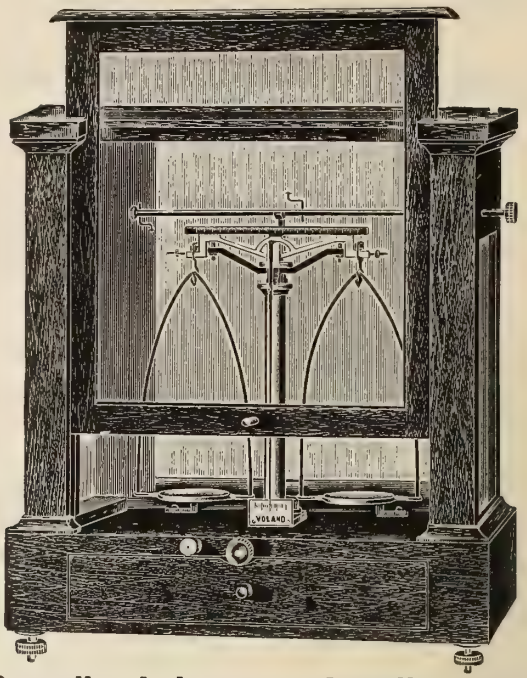

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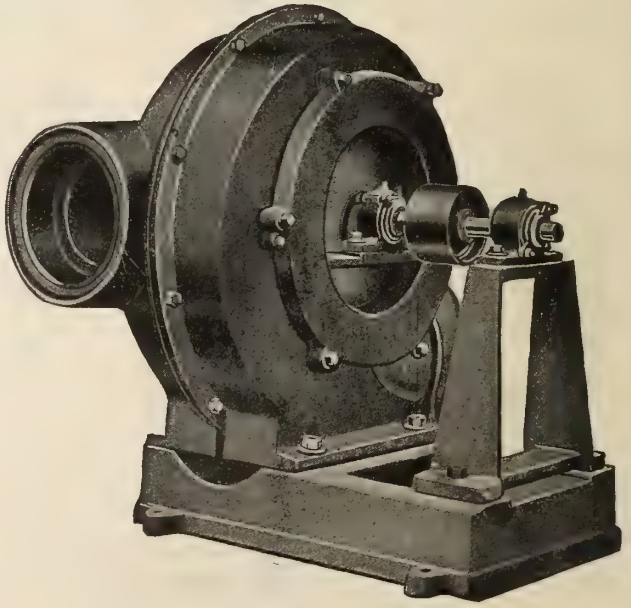

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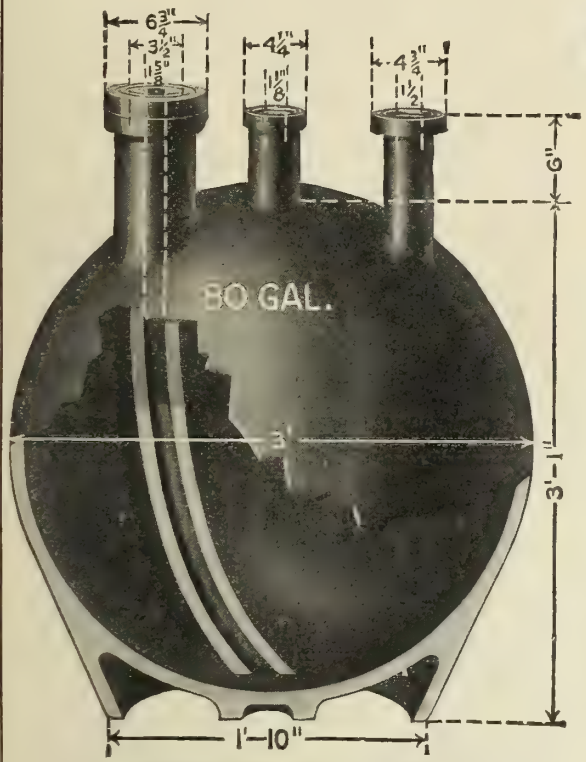

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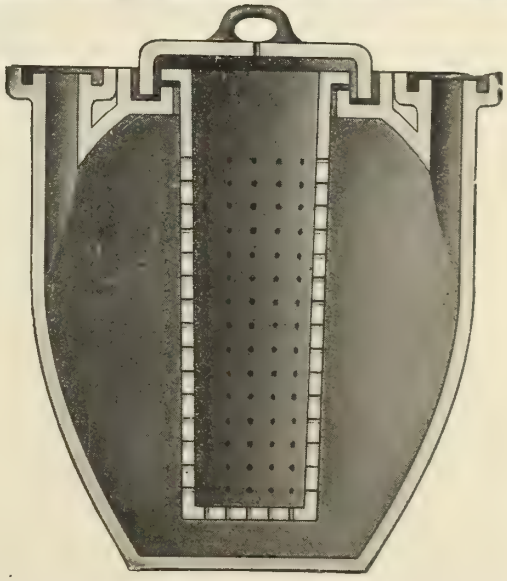

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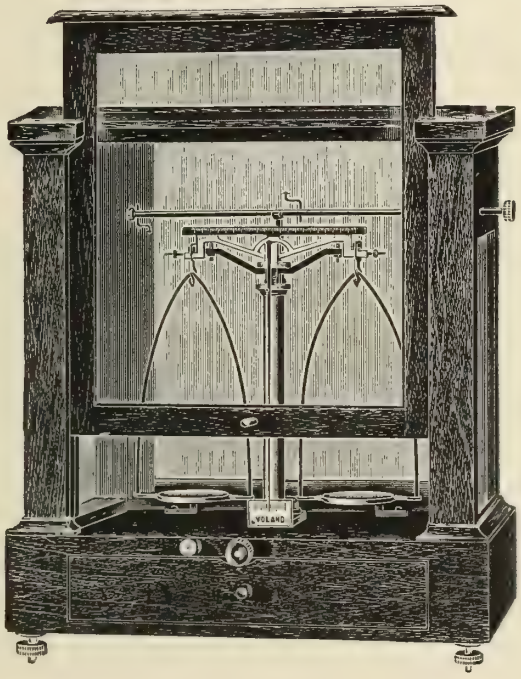

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The Glass Blowing Situation

Being No. 2 of a series of announcements dealing with our accomplishments during the war. The first appeared in the December issue; others will follow monthly.

THURINGIA and Bohemia, countries which are now the subject of universal discussion, had for several hundred years prior to the great war almost a monopoly of the glass industry of the world. Glass blowing establishments elsewhere in Europe and in America were called upon to manufacture only apparatus of special design or to do repair work. That is to say, all regular laboratory apparatus, the product of the labor of thousands of skilled glass workers of Thuringia and Bohemia, was imported to America by case lots.

Import houses like ours, who had in the past depended on them, were from the very beginning of the war entirely cut off from these countries; and it needs no vivid imagination to picture the serious condition then confronting laboratory supply houses, considering that there were not enough skilled glass blowers in France, England and the United States organized industrially to meet even a small part of the American demand.

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Adding another shop to our equipment at that time soon doubled our output; but it was easy to see that much more strenuous efforts were necessary to meet the demands which kept pouring in upon us. Firstly, additional factory space was needed. Secondly, additional equipment and machinery were needed. Thirdly, experienced glass blowers had to be attracted to our shops. Fourthly, promising young apprentices had to be engaged to learn the elements of glass blowing, glass grinding, calibrating, etching, and the many tricks necessary to this highly skilled trade; a trade which we have learned to respect as little short of an art.

How far we succeeded may be judged from the fact that to-day our force of glass blowers is nearly seven times its 1914 size; our output is possibly ten to fifteen times what it then was; and with it all we have maintained a standard **higher** than that of the far-famed Thuringian manufacturers. Our unequalled facilities are now available for handling peace-time orders.

A substantial share of credit for these accomplishments belongs to our customers and friends. Without their forbearance, we should not have been able to make such rapid progress toward factory production. In offering sincere thanks to our supporters for their patience and good-will during that trying period of uncertainty, when irritating delays in shipments occurred none too infrequently, we would only add that our efforts shall be continued, now that the war is over, in the hope of making this industry, fostered by their tolerant co-operation, a permanent one, worthy of other American achievements.

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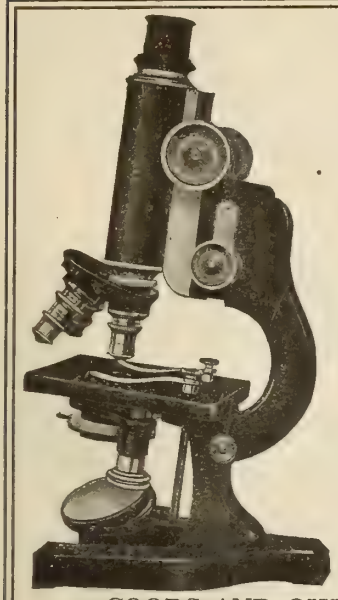

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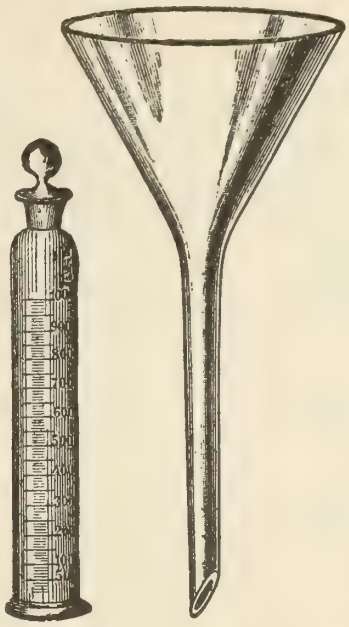

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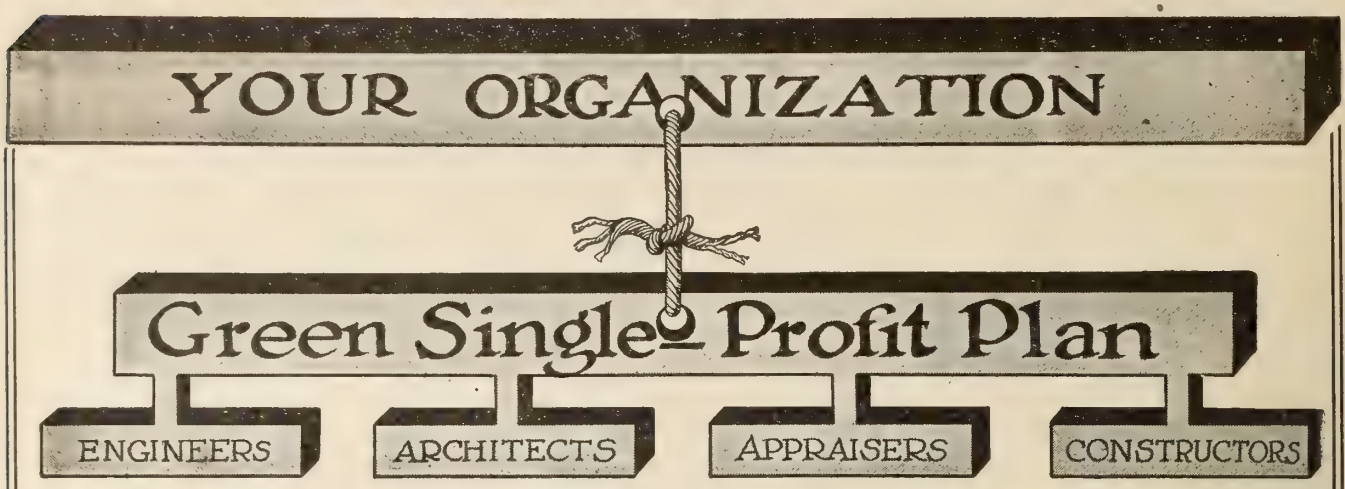

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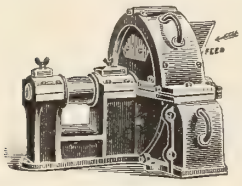

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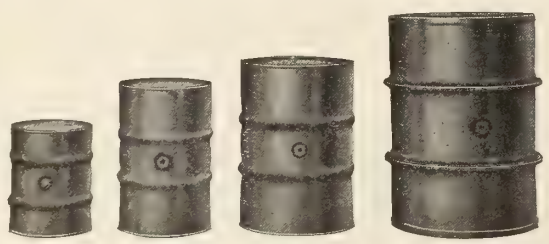

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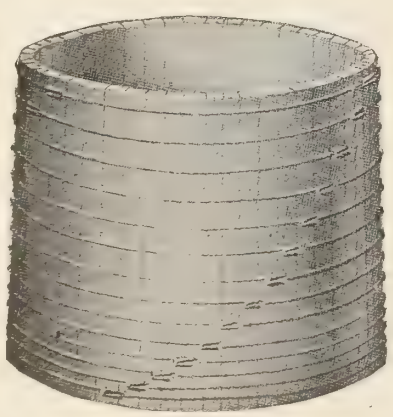

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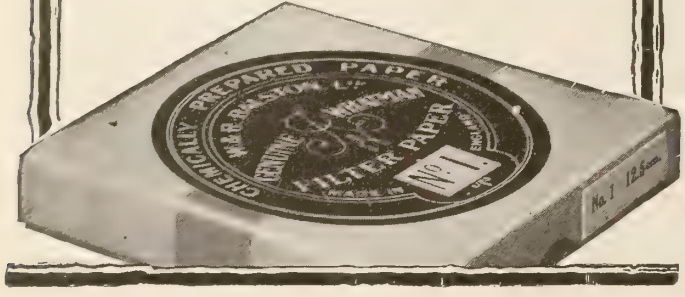

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The Editor will be pleased to receive for publication, original papers from chemists, engineers and managers dealing with the results of Canadian research work or descriptive of Canadian resources and their development in any way. Special arrangements of a very satisfactory nature will be made regarding reprints when required.

All secretaries of chemical organizations are asked to supply the Journal with news regarding meetings held and resolutions passed.

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Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

A WORD OF THANKS.

WITH this issue the Canadian Chemical Journal begins its third volume. During a space of less than two years, it has been enlarged four times. This could not have been accomplished without the whole-hearted support of both the industrial and academic chemists of Canada. We, therefore, take this opportunity to convey our good wishes to all those who, by their support, have made possible the publication of a Chemical Journal representative of Canadian thought and industry. It is our aim to remain continually at the service of all organized chemical societies, firms, individuals, or students interested in the field we cover. Canadian chemical interests have grown to the point where they are well worthy of broader public appreciation and attention. The aim of a single Dominion-wide organization among chemists is now before us, and a common medium of expression and intercourse is necessary. We ask our readers, then, to assist us in extending our influence, and we promise that all movements of interest during the year shall be reported faithfully in a language that Canadian chemists may fully appreciate and understand.

SUGGESTIONS FOR A 1919 CONVENTION OF CANADIAN CHEMISTS.

ALTHOUGH no formal plans were suggested at the First Convention of Canadian Chemists, held in Ottawa last May, for holding regular, annual gatherings, yet everyone felt that a beginning had been made, which would grow from year to year. The broad-minded spirit shown by the officials of the Society of Chemical Industry in making the first two days of last year's meeting a real general convention of chemists will most certainly be in evidence again this year at their annual meeting.

There are big problems in organization facing the chemists of this country, which should be settled at a time when settlement is easier than it ever will be in the future. Whether or not chemists meet under various organizations for ordinary local convenience,

they should certainly meet once a year under a representative Dominion-wide organiation, which should be established at the first opportunity. This in turn should only be a beginning. There are those who feel that the bonds of chemical union with the United States and Great Britain should be strengthened, and much of the underbrush of duplication cleared away. Our first work, however, is the immediate formation of an organization to include all Canadian chemists, in order that the movement for legal recognition and status may be supported by a united body of interested individuals.

Chemistry must appear on the outside, as well as the inside, of our industrial fabric. The analyst must discard his test tubes for a space and talk business with business men. At his conventions, he should strive to have mental meat on his table for the banker, the manufacturer and the industrialist. Theoretical papers, which have a very narrow industrial application, should be read by title only.

A convention is a business holiday, designed to stimulate action and enthusiasm, and should not constitute in part a Ph.D. oral examination.

If these things are remembered, there is every reason why the next convention of Canadian chemists, which in all probability will be held in Montreal, should attract not only all the chemists of Canada, but leading representatives from business circles here, as well as many chemists and business men from the United States.

THE LIGNITE UTILIZATION BOARD.

PERHAPS no single move that has been made so far by the Honorary Advisory Council for Scientific and Industrial Research has called forth such heated criticism and debate as has the whole scheme for briquetting the lignites of Saskatchewan. Both Canadian and United States authorities are investigating all the various proposals that have been made, and all agree that something must be done. We have in Canada a number of plans proposed. Some would seek a solution of the fuel shortage in these districts by re-adjusting freight rates, so that Alberta and Rocky Mountain coal might find a wider market. Others claim that by proper furnace design, the lignite may be utilized economically without any treatment. This aspect of the problem should receive the most careful consideration of the Lignite Utilization Board. Following a report by Mr. R. A. Ross, Chairman of the above Board, on the general feasibility of carbonizing and briquetting these fuels, the Dominion Government, in conjunction with the Provinces of Manitoba and Saskatchewan, appropriated $400,000 for the use of the Board. Although the immediate objective is the carbonizing and briquetting of the lignites of Southern Saskatchewan for domestic use, the Board is maintaining an open mind on the whole matter, and is at present investigating the various proposals for carbonizing, briquetting, binding or heat-treating coals. In this way, the Board should have at its command all known data, and no money should be spent on any construction until the information thus gathered has been digested.

Whether or not the original plans and figures upon which the Government took action will stand up under changed conditions, is not as important as having an organization composed of men who will approach the work of construction in a truly scientific manner. It is very necessary that this first major effort of the Honorary Advisory Research Council should prove to be based on sound economic and engineering principles.

In due time, construction work will be begun, and we believe that the magnitude of the problem will allow for the application of various methods of utilizing lignites with good success. In any event, neither private nor political interests should be allowed to entangle themselves with something that is so essentially economic.

SERVICES AND REWARDS

IT should not be forgotten for a moment that the most of the industries which have sustained our direct war efforts were created and made possible by the wonderful work of our leading chemical engineers and their staffs of laboratory workers. If industrialists and directors of labor could be made to carry the vision of possibilities arising from scientific work and research into the peace problems of industry, as they were forced to do in order to establish war industries, there would be fewer chemists seeking positions at the present time. Everyone knows what a premium was placed on the work of chemists during the war period, but few realize that this premium must continue, if we are not to fall away again into that pre-war disregard for industrial research in this country. On a moment's notice, the chemists of America were called upon to create vital industries of great magnitude from text-book methods, and less. This they did, and Canadian chemists and chemical industries have a very proud history in this connection. Now, when the stimulus is gone, along with the prospect of great profits, we find many firms turning a rather blind side to the possibility of finding further use for their chemists. Is it, or is it not, a fact that, if the chemists of the Allied countries had not come to the aid of the army and navy, the war would have been lost or delayed for years? There is no class of technical men who are better able to guide bankers, directors and heads of all industries, during the new peace warfare period, than our chemists. Everything is reducible to the basic principles of chemistry and applied science, if it is essentially economic.

The same men who have created war industries, if given an equal chance, would greatly assist and stimulate every industry in Canada simply because the principles of applied scientific research are broader than all present industrial applications. On the application of these principles hang our industrial future, and there should not be a single chemist in Canada left idle for a day. Some industry needs them, whether or not the men guiding the business have vision enough to see it.

Some time ago, it was stated that there were very few research workers in Canada, and the existing state of affairs was very much deplored by Government officials and people interested in a general way in the advancement of scientific research. It was further stated that the Honorary Advisory Council for Scientific Research was prepared to create one hundred industrial scholarships. Now would seem to be the time for the immediate putting into effect of this scheme. If the number of scholarships were reduced to fifty and the value of each doubled, a living wage would be available. No one doubts that the work done would more than repay the expenditure. Chemists, capable of doing good research work, are always seeking positions, and their efforts to impress either the Government or leaders of industry with their cash value have, in the past, been notoriously weak. Surely the time has come when chemists themselves will unite to form some Dominion organization capable of dealing with these problems.

FIRST-HAND OPINIONS ON GOVERNMENT-ASSISTED RESEARCH.

THE development of Government-assisted, industrial research is something that is receiving remarkable attention at the present time. The proposals of the Government have been given wide publicity, while very little has been heard from individuals who are at present directing those industries upon which it is proposed to try out a major experiment.

Everything connected with the plans of the Honorary Advisory Council is dependent upon the measure of co-operation given by the leaders of these industries. They must supply the real pressure which alone can hope to draw forth the necessary financial support from the Government. We have backed up the natural resources of our country by huge expenditures of capital, and we must now learn to stand behind the research brains of our ablest-minded men with an equal measure of encouragement.

For a change, we have left our study of the various currents and sub-currents of scientific life in Ottawa, and have gone for opinions to some of the industries about to be brought into line.

In general, it is understood that recommendations and resolutions have been passed by organized industrial bodies promising support for this work, and in a few cases urging action. At the same time, it appeared that advances had been made almost entirely by the Government, and we felt that the whole matter was worthy of more discussion by those men who, after all, must take the leading part in industrial research. We, therefore, wrote to thirty-four managers of large industries in Canada, asking them for their opinions regarding the efforts being put forth by the Government in the interests of industrial research in this country. On the whole, great interest was shown in the proposals for assisting research and every evidence was present to indicate co-operation among the industrialists consulted. Where it was true that the research organization of the company was greater than any probable co-ordination of Government and rival concerns, it was frankly stated that the company would continue to carry on its research work behind closed doors. Some criticism of the handling of present Government laboratories was evident. It would seem that there is a strong opinion in certain quarters that the Mines Branch in Ottawa and the Forest Products Laboratories in Montreal have not been run to the best advantage of the industries they represent. It is hard to create faith in a new project as long as reasonable criticism may be directed at well-established Government effort. The facilities of these organizations have not yet been exhausted, and some see no reason for creating new machinery and buildings until present laboratories are greatly speeded up. Other replies would show that there were some men, of great power financially, who have simply been dazzled by the flares of scientific research. They have caught the contagious, popular disease, "research," and would most heartily vote money for any scheme that in a general sort of way would reimburse science for the millions she has made them. These men crowd our honorary councils, but they cannot comprehend the concrete in research matters and must fain be fed with generalities. Eventually, they become stern judges, considering, not efforts, but results. They have the directors' habit. Many men of influence desired to reserve their opinions, until something more concrete was proposed.

Portions from selected replies all show that if co-operation will assist in solving industrial problems, this will be offered freely.

ALGOMA STEEL CORPORATION.

The Canadian Chemical Journal.

"We are in receipt of your letter with reference to the establishment by the Government of guilds for industrial research purposes, and in reply wish to advise that we should be willing to co-operate in every possible way in this matter.

"(Sgd.) D. KYLE,
"Vice-president."

NORTON COMPANY, NIAGARA FALLS, N.Y.

"In general, the virility and progressiveness of individuals in an industry is brought about by the keenest competition and wherever competition has been removed, there is always a tendency to be satisfied with the current conditions. A co-operative system of research would remove largely, in the writer's opinion, incentive for individual progress. The patented processes and the trade secrets are usually the result of research in some form by an individual and the benefits to be derived, the writer believes, should go where they have originated. The large manufacturer, in entering a guild system, would probably furnish the greater part of the benefits to be derived by the industry as a whole, and would be the gainer to a very small extent. The writer believes research should be promoted and encouraged, but after many years of experience along this line of work, he can truthfully say that any company, large or small, who conducts such thoroughly and systematically, can make profit out of it by doing it themselves.

"We realize that the smaller firms may consider it venturesome to risk comparatively large expenditures with the possibility of failure of a piece of experimental work, but spread over a period of years, we are firmly convinced that returns will be as large by such an investment as in any other branch of any business.

"(Sgd.) L. E. SAUNDERS,
"Manager."

DOMINION CANNERS, HAMILTON.

"We have our own laboratory and chemist, who is working out our problems, and, therefore, we doubt if the guild referred to by you would be of much benefit to us.

"(Sgd.) DOMINION CANNERS, LTD."

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"Replying to your letter of the 21st inst., the necessity and importance of industrial research was never so great as at present, and the importance of such should be emphasized in every way, and it is quite possible that the establishment of "Guilds" may be of considerable benefit, as a certain amount of national (if I may use this term) research work can be accomplished by co-operation, but I am of the opinion that as a rule manufacturers will, in a large measure, desire to derive the benefits from any research work they themselves may do, rather than make the results public.

"I am strongly of the opinion that an institution, such as the Mellon Institute, Pittsburg, should be provided for Canada.

"There are, of course, some great problems which should be worked out by the universities, in connection with the Advisory Research Council.

"(Sgd. E. G. HENDERSON,
"President."

THE RIORDON PULP AND PAPER CO., MONTREAL, QUEBEC.

"The pulp and paper trade established such a guild, as I understand the Government proposes, several years ago, and the results are eminently satisfactory.

"(Sgd.) CARL RIORDON."

LAURENTIDE COMPANY, LIMITED, GRAND MERE, P.Q.

"I feel that this is a most important matter for the industries of Canada, but regret to say that I have not much confidence in the proposal of the Government to take matters of this sort up during these present times of war stress.

"The Government, as you perhaps know, have been operating for a few years past a Forest Products Laboratory at Montreal, in which there is a branch supposed to be devoted to the pulp and paper industry. This laboratory has quite a bit of valuable equipment for research in paper-making problems; but, on account of inadequate appropriations for proper salaries to induce men of ability to carry on this work, the laboratory has been practically doing nothing for the past year. If this condition is allowed to exist in the laboratory that is already started and organized, I cannot be brought to feel that there is much hope for any practical results to be obtained from this proposed new organization.

"(Sgd.) F. A. SABBATON,
"Assistant Manager."

BRITISH AMERICAN NICKEL CORPORATION, LIMITED, OTTAWA.

"There is not the slightest doubt that it would be of the greatest value to the country if industrial research work could be done on wide lines, and the demand for such work will increase very rapidly as its benefits are appreciated.

"(Sgd.) W. A. CARLYLE,
"Manager."

THE E. B. EDDY COMPANY, LIMITED, HULL, P.Q.

"We are very much interested in the Government's proposal to establish "guilds" for industrial research purposes.

"(Sgd.) J. T. SHIRREFF,
"Vice-President."

IMPERIAL OIL, LIMITED, TORONTO.

"All our research work is done in our own laboratories in conection with our business, and is of such a nature that we do not care to disclose the same.

"(Sgd.) C. O. STILLMAN,
"Vice-President."

E. D. SMITH & SON, WINONA, ONT.

"I think the Government is acting wisely in lending the greatest possible encouragement to chemical research that may result in more advanced methods in many of our industries. In our own particular industry, we have no questions of importance that we know of requiring extended research, but, doubtless, in many minor ways we might be benefited by a greater knowledge of chemistry.

"(Sgd.) E. D. SMITH."

As a summary of opinion from manufacturers, we would say that as long as the research is kept along purely scientific lines, co-operation will be forthcoming, but when financial and trade co-operation is suggested, with possible leakage through Government investigation of information regarding methods and costs of producing products, undesirable competition is feared, which will tend to break up the guilds.

LARGE ENDOWMENT FOR HARVARD UNIVERSITY.

The late Capt. Jos. Raphael de Lamar, of New York, who had been a mine owner and director in many large Canadian and American enterprises, left the sum of $10,000,000 to Harvard University Medical School, Johns Hopkins University, and the College of Physicians and Surgeons of Columbia University to be devoted to medical research into the cause of disease and the principles of correct living.

The Sub Laboratories of the Department of Trade and Commerce, Vancouver, B. C.

By J. A. Dawson, B.A., Public Analyst in Charge

THE first half of "laboratory" spells "labor." Therefore, I shall not inflict a matter-of-fact description of our laboratory facilities and functions without due regard for a correlation with the general movement of the times.

To one who surveys the "per saltum" progress of this changing world; it is manifestly evident that we to-day are playing our parts on a fairly vertical gradient. Looking backward, we see the long centuries with successive billows of Aryan humanity sweeping over the world, rising, ruling and progressing. For a century after Waterloo, the slow course of evolution proceeded quietly with occasional ripples. Now we have reached another transition stage. Old phases are passing away and new phases appear. The rates of reaction in the systems of religion, art and science are producing rapid transformations. In the present great world revolution, Aryan humanity has submerged Hun barbarism. In this, the theologian, the artisan and the scientist have each taken their cue. The greatest contribution, however, has been from the scientist and more particularly the engineers, physicists, biologists and chemists.

If we in Canada consider the rapid evolution of our activities in recent years, we note that the most marked of all developments have been those of science. From coast to coast many new chemical and metallurgical industries have been established. In the period centering upon the outbreak of the war, new Government and Educational laboratories have been established in every large city of Canada. At Halifax, the sub-laboratories of the Department of Inland Revenue; at Montreal, the Forest Products Laboratory and those of Macdonald College, both associated with McGill University; at Ottawa, the Dominion Observatory, the laboratories of the Mines Department, also extensions to the laboratories of the Inland Revenue Department and to the laboratories of the Department of Agriculture; at Kingston, the Chemistry Building (Gordon Hall) and the Metallurgical Building (Nicol Hall); at Toronto, the Chemistry and Mining Building, the Physics Building and the Pathological Laboratory of Toronto University, the Science Laboratories of McMaster University and the new City Technical Institute; at Guelph, the new Physics Building and the extension of the Chemistry Building of the Ontario Agricultural College; at Winnipeg, the Agricultural College, the Grain Inspection Laboratory of the Department of Trade and Commerce, and the sub-laboratories of the Department of Inland Revenue; at Saskatoon, the laboratories of the new University of Saskatchewan; at Edmonton, the laboratories of the new University of Alberta; at Vancouver, the laboratories of the new University of British Columbia, and the sub-laboratories of the Department of Inland Revenue; at Victoria, the new Astrophysics Observatory of the Dominion Government. Doubtless, there are others that might be listed, if space permitted. It is noteworthy that the first President of the new University of British Columbia, the late and deeply lamented Doctor F. F. Wesbrook, was a Canadian scientist of international fame.

VIEW OF VANCOUVER HARBOR, LOOKING TOWARD THE ENTRANCE, C.P.R. PIER A AND THE EMPRESS OF INDIA.

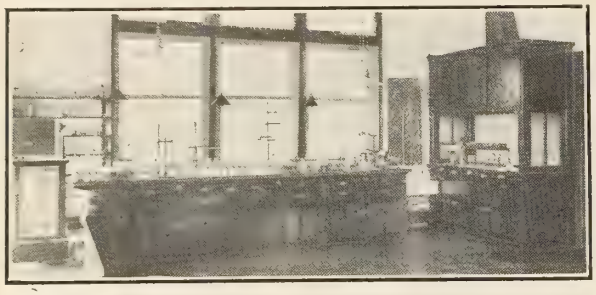
As a consequence of the war, we now have our Advisory Council of Scientific and Industrial Research, with the organized survey of scientific skill, equipment and natural resources with the recent suggestions of Trade Guilds for Industrial Research and of a National Research Bureau. The Imperial Munitions Board have developed an organization of scientific research experts. The Geological Survey has opened a branch office in Vancouver and the Mines Branch a platinum assay laboratory.

The Society of Chemical Industry has experienced marked developments. A sub-section of the Canadian section has been formed at Ottawa and a new local section at Vancouver, with the hope of another section at Winnipeg.

Under the auspices of the Society of Chemical Industry, the first convention of Canadian chemists was held at Ottawa last summer. Finally, we have our new Canadian Chemical Journal, of which we are justly proud. Without it, it would be difficult to form a strong national organization of chemists in Canada. May we speed it wisely.

The description of various Canadian laboratories, which commenced with the November, 1917, issue of this Journal, has enabled us to realise the magnitude of our scientific development. Mr. L. E. Westman, M.A., has already recorded the history and functions of the laboratories of the Inland Revenue Department at Ottawa and of the sub-laboratories at Halifax, Winnipeg and Vancouver. (This Journal, February, 1918, p. 33.)

The locations, plans and equipment for the new branch laboratories were arranged under the supervision of Dr. A. McGill, Chief Analyst, early in 1914. The Vancouver laboratories were opened in February, 1915. Temporary quarters



FIRST LABORATORY, SHOWING "LABOR" TABLES AND FUME CUPBOARD.

were found in Postal Station B on Hastings Street. A very complete equipment for the physical, chemical and bacteriological examination of foods, drugs, fertilizers, etc., had been provided. Among the more important items may be mentioned: Fric Polarimeter, Abbe refractometer, butyro-refractometer, immersion refractometer, Duboscq colorimeter, polarizing microscope with filar micrometer, electric oven and incubator, electric muffle furnace and centrifuge, pressure autoclave and sterilizers, electric motors, storage batteries and grinding mills and all the accessory apparatus and chemicals for routine examination of a large number of samples forwarded from the districts of the Rocky Mountains, Vancouver and Victoria.

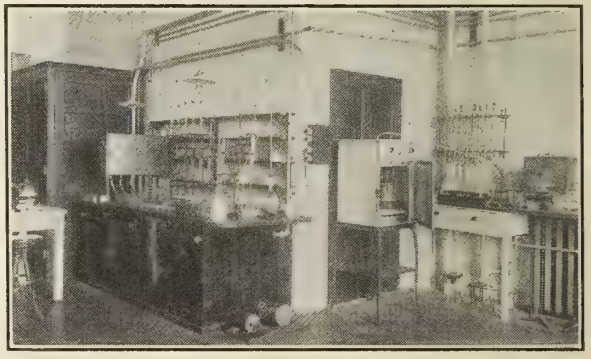
In the summer of 1915, Dr. Douglas McIntosh came from McGill University to the new University of British Columbia as Professor of Chemistry. The establishment of the cult of chemistry on the Canadian Pacific coast may, therefore, be considered as dating from the year 1915, some 338 years after the first Englishman, Capt. Francis Drake, in the "Golden Hind," sailed the Pacific along the Western coast of America and wrote of our high, snow-covered mountains, with their "frozen nimphes and stinking fogges." About that time, van Helmont, the iatro-chemist of Brussels, laid the foundation of the first exact knowledge of gases.

In March, 1918, these laboratories were moved to more permanent quarters in the new Customs Examining Warehouse on the harbor front. The windows over the "labor" tables give lighting from the north, and from them there is an extensive view of the docks and ships, the harbor and the mountains. To the east, may be seen the incinerator of the Hastings Lumber Mill, which adds a considerable quota to the 15,000 cords or so of mill waste said to be destroyed in the sawmill burners on the coast every twenty-four hours. Beyond that is the British Columbia Sugar Refinery, with a Scotch chemist controlling. Beyond the wooden and steel ship yards, on the opposite side of the harbor, rises Crown Mountain to a height of some 4,000 feet, with the "Camel" faithfully facing towards Mecca. Then Capilano Canyon intervenes, and supplies us with a never-failing source of glacier water distilled by Nature. To the west, over Stanley Park, are the Britannia peaks, with the "Lions" presiding over our British destiny, and the largest copper mine in the British Empire.

Last September, all the laboratory services of the Department of Inland Revenue were transferred to the Department of Trade and Commerce. With this change have come suggestions regarding the re-organization of some features of the present system of foods and drugs inspection.

The routine of watch-dogging the purity of products for the people leaves little opportunity for organized, original research. It is frequently necessary, however, to carry on investigations to decide upon or establish methods of analysis. Within the last year, a system of co-operation among the public analysts of the four laboratories has been considerably extended and the further development of this should lead to a very desirable definition and uniformity of methods. Frequently difficult problems confront the public analyst as to interpretation of results. Much of this is due to the lack of mathematical and scientific exactness in the description of methods relating to published analytical data. Frequently the methods used are not disclosed. Many works of reference on food and other products quote figures without reference to the original source and many of the percentages add up to 100 exactly without indicating which constituent was reported by difference. There is much to be gained by developing a thoroughness and a conscience such as that of many inorganic chemists, who determine each constituent separately and are not satisfied until the total is at least within 0.5 of 100 per cent. (See, for instance, Data of Geochemistry, F. W. Clarke, U. S. Geological Survey.)

A few of the more noteworthy problems that have been investigated to some extent in this laboratory are as follows: (1) The approximate quantitative determination of wild or Bombay mace in admixture with true mace; (2) a critical investigation of the accuracy of the so-called 10 per cent. extract method for the quantitative determination of chicory in coffee; (3) methods of determining the total solids in lime-fruit juice; (4) methods of determining the total phosphate in basic slag; (5) methods of determining the total nitrogen in fertilizers containing mixtures of nitrate and organic nitrogen compounds; (6) investigations lead-



SECOND LABORATORY, SHOWING DARK ROOM, KJELDAHL STILL, ALCHOHOL STILL, KNORR EXTRACTION AND McGILL OVEN.

ing to a reasonable interpretation of the terms "the temperature of boiling water" and "dry to constant weight," as given in some official methods for total solids in saccharine products; (7) accuracy of various methods of determining the hydrocyanic acid yielded by Burma or Rangoon beans; (8) methods of determining small proportions of camphor in patent medicines; (9) the detection and estimation of very small proportion of nickel in lard substitutes; (10) a

critical investigation of the nitric acid test for cottonseed oil in admixture with lard. The results of some of these investigations will be found in the series of bulletins issued by these laboratories.

In Canada, we are particularly fortunate in having standards for food, drugs, etc., that apply uniformly throughout the whole of the country. This is of great importance in developing our internal trade. The revision of established and the setting up of new standards progresses with changed conditions and according as sufficient data are acquired by research. During the last year or more, some progress has been made in the inspection of imported products at the time of entry. It would appear to be a logical development that this inspection of products at their source of entry or manufacture should be gradually extended.

Probably the greatest difficulty in developing the present system is the lack of trained chemists capable and willing to undertake the work. The rules of the game of the world are such that chemists are paid less to-day than are most other professions, and under present conditions much less on the average than most artisans engaged in ship-building, etc. This is to be attributed mainly to lack of organization, or, in other words, to lack of progress on the part of the chemists as a whole. One has but to consider the status of the chemists serving the United States Army in laboratory, industry or field, in order to appreciate the benefits to the chemist and to his country by organization. That the establishment of the chemists of Canada upon a strong professional basis would re-act greatly to our national development, needs no argument. Organization advances civilization.

As I write this, I hear outside the welcome celebrations of the peace and victory which has come after four years in the wilderness. We, as chemists, have helped to conquer the barbarians. Now let us conquer our inertia. As exponents of the scientific method, we are accustomed to classify and marshal scientific facts. Let us apply this method to our social development. The world is in a plastic state; let us mould it while we may!

CANADIAN PATENT OFFICE RECORD.

The Department of Trade and Commerce have issued a notice that on the 7th January, 1919, The Canadian Patent Office Record will be issued weekly, simultaneously with the issue of patents therein described.

This is a decided advance, as at the present time the monthly issues are nearly three months in arrears. The weekly edition will bring the Canadian Record in line with the British and U.S. issues.

The new system will give the Patent Office the opportunity of incorporating a number of additions and valuable improvements, which it is to be hoped will be found in the weekly issue. Among the most important of these may be mentioned:—

I. A list of applications, giving title, name of inventor, name of assignee, date of foreign patents issued.
Section 8, Par. 1, of the Patent Act makes it necessary to apply in Canada within one year from the date of the first foreign patent issued.
It is, therefore, important that the dates of applications should be known, as the rights of the public are affected by them. Failure to apply within the year gives the public the unrestricted use of the patent.

II. A list of patents subject to compulsory license.
In Great Britain, all patents are subject to compulsory license, but in Canada it is a matter of special application and, therefore, this information should be published.

III. A list of extensions to import and to manufacture, under Sections 39 and 40 of the Patent Act.

IV. A list of patents that have lapsed for non-payment of renewal fees, or a list of renewals.
As most of the patents issued are for a term of six years only, it is important to know which have been extended and which have become public property.

V. A list of re-issues.
Hitherto, re-issues have been mixed up with new patents and indexed with them. Re-issues are, however, simply continuations of the original patents and continue to date from the original date of issue. They should be numbered in a distinct series and indexed as re-issues.

VI. Rules and Orders in Council relating to patents, trade marks, etc.
These should be published in the Patent Office Record.

VII. Decisions of the Commissioner of Patents and decisions of the Courts relating to patents. Decisions of arbitrations in conflicting cases.

It is essential that all decisions of the Patent Office should be published, in order to establish a uniform practice.

VIII. The Annual Report of the Commissioner of Patents should be published in the Patent Office Record.

IX. The list of designs should be illustrated.
The public is interested in seeing what are the features of the design which has been registered, in order to avoid infringement.

X. The list of trade marks registered should be illustrated.
In both Great Britain and the United States, the trade mark to be registered must have been published for over a month, to permit of opposition by interested parties, before the application will be granted. This system should be adopted in Canada, but, in any case, there should be an illustrated record of trade marks available.

XI. A list of renewals of trade marks should be published.

XII. The list of copyrights should be classified.

XIII. The indexes should give title, name of applicant, name of assignee, official number, date and page.
At present, the page is not given in the indexes of patents.

No indexes of designs, trade marks or copyrights have been published in the past.

XIV. Advertising.

The Illustrated Official Journal of the British Patent Office contains fifteen pages of advertising matter.
These advertisements are under the control of the Government contractors for trade advertisements entirely distinct from the Patent Office.
The revenue from these pages is, no doubt, large.
The addition of advertising pages to the Patent Office Record would provide a suitable medium for notices of patents for sale, license to manufacture, etc.

The War and the Nitrogen Industry

A Review of the Development of the Nitrogen Industry and a Discussion of the Present Situation as Brought About by War Activities

By W. D. Landis

JUST sixteen years ago, the writer had the good fortune to see in operation at Niagara Falls the first large-scale unit for the fixation of atmospheric nitrogen. This costly experiment of Bradley and Lovejoy did not prove the commercial success anticipated, but in its two years of operation served to attract the attention of the world to the nitrate phase of the industry. The principles so well demonstrated at Niagara, when carried to Europe with its more favorable natural advantages and economic conditions, started a development that has commercially survived to the present time. Had Bradley and Lovejoy enjoyed the advantages of Norway, we might to-day find their names as prominent in the industry as Pauling and Schonherr, if not Birkeland and Eyde.

The fixation of nitrogen has developed along three divergent lines with many secondary outgrowths. The oldest process dated back to Cavendish, who in 1785 undoubtedly produced some nitric acid by passing the electric spark through air. Bradley and Lovejoy in 1901 attempted to do the same thing on a commercial scale, and had their apparatus in operation in 1902. Just about the time the Niagara work was abandoned, Birkeland began his experiments in Norway, using a somewhat different style furnace. Schonherr followed with his furnace, and still later Pauling. The product of all of these processes was nitric acid or derivatives of the same. Many others have since entered the field, but have made little progress in a commercial way.

A second school, and I am including here only those processes which have survived in one form or another, is that which concerned itself with the fixation of atmospheric nitrogen in the form of cyanides and cyanamids. Frank and Caro for many years attempted to produce cyanide through the direct fixation of atmospheric nitrogen. Commercially unsuccessful in this attempt, they, however, succeeded in a small way in producing cyanamid from atmospheric nitrogen and calcium carbide, about 1900, or just prior to the nitric acid work of Bradley and Lovejoy. They did not, however, make much progress in the development of their process in the early days, and it was not until 1906 that a commercial installation followed. Later followed the conversion of cyanamid to ammonia, and quite recently the oxidation of this ammonia to nitric acid.

The third school following the production of ammonia synthetically, from its elements, nitrogen and hydrogen, is represented in the work of Haber, and carried out almost simultaneously with Birkeland's developments in Norway.

These three systems of fixation which have survived to the present time are none of them twenty years old, and, in fact, essentially had no producing capacity, even twelve years ago. Ten years will actually cover the commercial history of the industry.

Before the advent of the fixation processes, the world's requirements of nitrogen were met by the nitrate beds of Chili, the recovery of ammonia in the coking of coal and the production of illuminating gas, and from various vegetable meals and animal by-products. We are going to consider only the chemical nitrogen product in our further discussion.

According to the best available statistics, ten years ago, or in 1908, the world's production of nitrogen in the form of Chilian nitrate and of sulphate of ammonia was equivalent to only 503,000 short tons of nitrogen. The fertilizer industry was the larger consumer of this nitrogen, and since the capacity of the cultivated acreage of the world for absorption of this nitrogen was fifty or one hundred times the above production, there was ample incentive for the development of an air fixation process.

In 1914, at the outbreak of the European War, the producing rate of the world in short tons of chemical nitrogen, according to the best available statistics, is given in the following table:—

Material.	Short tons of Nitrogen.
Nitrate of soda	425,000 tons
Sulphate of ammonia	285,000 tons
Arc process products	11,000 tons
Cyanamid products	31,000 tons
Synthetic ammonia and misc....	12,000 tons
Total—short tons nitrogen.....	764,000 tons

In 1919, say, five years later, the producing capacity of the world, including the United States Government nitrate plants now under construction, is estimated to be as follows:—

Material.	Short tons of Nitrogen.
Nitrate of soda	520,000 tons
Sulphate of ammonia	330,000 tons
Arc process products	15,000 tons
Cyanamid products	360,000 tons
Synthetic ammonia and misc....	116,000 tons
Total—short tons nitrogen	1,341,000 tons

An analysis of the production statistics of the world for ten years prior to the outbreak of the war shows a very uniform rate of increase. The curve is almost exactly a straight line. If we carry this rate of increase forward into the future, it indicates a producing rate for 1919 of 1,330,000 short tons of nitrogen, or essentially the same as our figure given above for actual production, 1,341,000 tons. Such a system of analysis, it seems, is justified, in view of the very uniform rate of increase noted for years prior to the war, and we are forced to the single conclusion that as relates to the world as a whole, there has not been the great over-expansion of producing capacity most of us have believed. The available nitrogen supply expanded under the influence of the war only to the point anyone would have predicted in the spring of 1914 from a study of its past statistics.

In this connection, it might be here added that about 1911 the world's production of nitrogen began to catch up with market demands as limited by the comparatively unexpanded trade channels, which had not kept up with the increase of production. Prices slumped as a result, reaching the lowest point in the history of the industry in 1914, and only the outbreak of the war, with its insistent de-

mands, saved a portion of the industry from a financial disaster.

It is a question if a problem is confronting the world's nitrogen industry at the close of the war. Undoubtedly, the demand will drop off somewhat with the advent of peace, but with the anticipated high food prices continuing for some time afterwards, this drop in nitrogen consumption should not be excessive. On the other hand, many plants erected under the war-time emergency are so located geographically and economically that operation after the emergency is past will be impossible. We may, therefore, expect a material reduction in producing capacity. That the decrease in demand and in production will be somewhat of the same order is at least a plausible assumption, and we see no real reason for altering our earlier conclusion as to the existence of a real primary problem as concerns supply and demand.

Of secondary interest, there is bound to be much readjustment of prices, markets, distribution, etc., for the new plants are located in many cases in consumption centres formerly drawing from a distance for their supplies. Former importers may become exporters and new products must supplant old varieties of materials. Legislation may even play an important part in affecting consumption, not alone of the nitrogen, but even of the specific variety. The influence of these phases, secondary, in a sense, to supply and demand, cannot be foretold. A recurrence of the 1914 condition may ultimately occur again, particularly as there has been no expansion of propaganda and educational methods and sales organizations since 1914.

In the case of the United States, the statistics, however, partake of a very difficult character.

In 1914, the United States possessed no commercial fixation plants. The consumption was as follows:—

U. S. Consumption of Nitrogen in 1914.

Material.	Short tons of Nitrogen.
Nitrate of soda (import).....	94,300 tons
Equivalent sulphate of ammonia (domestic)	36,600 tons
Equivalent sulphate of ammonia (import)	17,800 tons
Cyanamid products (import)....	5,400 tons
Total—short tons nitrogen	154,100 tons

It is extremely difficult to estimate for 1919 a similar consumption rate. I am, however, reproducing here some figures which are at least representative of the magnitude to which the industry has grown, having included the best information on anticipated outputs of coke ovens and on the new Government nitrate plants now under construction and which will e in operation very early in the spring.

Estimated Production Rate, 1919, U. S.

Material.	Short tons of Nitrogen.
Nitrate of soda	300,000 tons
Equivalent sulphate of ammonia	100,000 tons
Cyanamid products (import)....	13,000 tons
Cyanamid products (domestic)..	86,000 tons
Synthetic ammonia	10,000 tons
Total—short tons nitrogen.....	509,000 tons

The producing rate in the early part of 1919 will, therefore, be approximately three times that at the outbreak of the war. Before the war, half the chemical nitrogen entered into the fertilizer industry, which for a considerable period of time has shown an increase of only about 10 per cent. from year to year. Assuming this increase, applied to the whole industry, would have continued for the duration of the war, it is hardly to be expected that the consuming capacity at the beginning of 1919 should exceed 225,000 tons of nitrogen per year, had there been no war.

Judging from past history, our only guidance, we can expect at the close of the war a more or less disturbed state of affairs lasting over an indefinite time. We have no reason for assuming an enormously increased market for nitrogen to develop with peace, and, in fact, the chances are greatly in favor of a decline below the estimated 225,000 tons. With a production capacity of over 500,000 tons and a maximum consumption of less than half that tonnage, the industry in the States faces an unusual problem.

Importation of nitrate of soda makes up over half the available tonnage. Undoubtedly, a material reduction of this import will follow peace, possibly sufficient to balance supplies and demands. There will always be some demand for nitrate of soda in agriculture and the oxidation of ammonia will make only slow headway in the already equipped and amortized chemical plants, so we cannot hope for a complete cessation of nitrate imports. Certain fixation plants erected as war emergency plants will undoubtedly close down with the declaration of peace, or at least suspend during a period of removal to more favorable market localities. Exportation of surplus production is not excluded from contemplation.

The nitrogen industry of the States must undergo a complete change we must all admit. This enforced change, I believe, need not seriously affect the great producing interests of this country, but the distribution agencies are certain to be influenced. The changes of methods and materials will affect the consumer. Out of the whole, can come much good.

For example, prior to the war, agriculture consumed about 50 per cent. of the chemical nitrogen in the whole country in the form of mixed fertilizers. The ingredients, mostly low in content of plant food, and collected from many places, were assembled at the seaboard and compounded there. This low plant food content, varying from 12 to 20 per cent. of the whole, means high cost of assembling, mixing, bagging and transportation per unit of plant food. By the time the fertilizer had been transported, 200 to 300 miles inland and distributed under an expensive system of credit, the nitrogen cost the farmer about double its wholesale price at the ports. As a result, 85 per cent. of the fertilizer consumed in the country was used in a narrow strip of territory near the coast, and the enormous acreage of middle western cultivated lands went unfertilized. The high cost of the dilute fertilizer, when transported to these States, made its use either impossible, or at least unattractive to the farmer from the standpoint of profitable return. The great cereal crop-growing regions must have cheaper nitrogen to make available the vast market they present.

Now either the producer of the raw materials or the compounder of the mixed fertilizer were profiteers. A careful study of the situation, and statistics are available in ample quantity, showing that neither profited to more than a very moderate return on his invested capital. The difficulty lies in the enormous friction losses in handling a material

averaging only between 12 and 20 per cent. of valuable plant food and 80 to 88 per cent. inert material. The labor, bags, freight and haulage, applied to the inert material, is lost. If it could be eliminated, the cost of fertilizer could be reduced without either the producer of the raw materials or the compounder and distributer of the same suffering. With reduced cost to the farmer and more general distribution, the cost of credits will be lowered. Half the price paid by the farmer went to the wholesaler of the raw materials, and the other half for distribution. As this second half is largely proportional to the bulk handled, any means of reducing the inert material content should result in a lowering of these costs of mixing, bagging and distributing. The solution of the problem of a lowered cost of fertilizer is, therefore, logically one involving the production of a more concentrated material. And following the lowered cost will come the newer and larger markets with increased demand.

The nitrogen industry of the United States, if it is to market its great production at the close of the war, must face these facts and be prepared to meet the issue. One of the youthful fixation processes has appreciated the situation and prepared itself through development of a concentrated fertilizer containing some 65 per cent. of plant food, over four times as concentrated as an average mixed fertilizer. The cost of handling, mixing, bagging, freight and haulage will be cut in equal proportion to the concentration, and it will be enabled to reach hitherto inaccessible markets, miles beyond the limit of the present dilute materials. The new fertilizer awaits only the close of the war and release of the ammonia supplies to enter the field, crop tests having been carried out for some four or five years.

When fertilizer can be profitably put into the great middle west, the consumption will be enormous. Our apparently largely increased nitrogen production will not suffice to meet the demand. It would take the stimulating effect of several wars to build sufficient fixation plants to over-produce in such a market.

Thus the ten-year-old fixation industry, with its freedom of action, absence of prejudice, and broad appreciation of fundamental condition, has not only come to the assistance of the Government in the war emergency, but has prepared itself to meet what might have been a serious national problem with the advent of peace. A closing of the plants, with the world's shortage of food stocks, is unthinkable, and yet such would appear on the facts of statistics to have been the outcome, had the problem not been attacked from its fundamentals. At least, some of us do not look into the future with fear, in spite of the figures.

CANADIAN CHEMICAL AND METAL PATENTS.

Reported for the Canadian Chemical Journal by A. E. MacRae, Ottawa.

Gold Concentrator, A. R. Mackie, Can. 185, 636, July 23, 1918.

Structure Sheet Glass, Edward Danner, Can. 185, 600, July 23, 1918. Molten glass is caused to flow down a heated slab in a heated atms., and is continually drawn from the lower end of the slab.

Hydrocarbon Oils, R. H. Brownlee, Can. 185, 052, June 25, 1918. The yield of low-boiling liquid products is increased by introducing steam adjacent the lower extremity of a vertically extending pipe system maintained at a temperature of over 800° F. and a pressure of over five atms., introducing the oil below the upper extremity of the system, continuously separating the heavier components from the lighter vaporized products and permitting a reflux of the former through the system, so that the heavier components separated at any point undergo a further treatment in the presence of a lesser concentration of the lighter products than of the point of their separation.

Plastic Compound, E. L. Sharpneck, Can. 184, 720, June 4, 1918. A composition for pavement contains a finely divided filler, mineral asphaltum, silica, iron oxide, alumin oxide and SO_3.

Resin, F. W. Sperr, M. Darrin, Can. 184, 890, June 11, 1918. Crude solvent naphtha is subjected to heat and pressure in the presence of a catalytic agent.

Hydrocarbon Extraction, V. Z. Read, Can. 185, 181, June 25, 1918. Shale or coal is submitted to destructive distillation in one chamber, the distillate is passed into a second chamber containing similar shale or coal to dissolve material from the shale and the solvent and extracted matter are recovered.

Process and Apparatus for Procuring and Stimulating Rainfall, J. G. Balsillie, Can. 187, 270, Nov. 5, 1918. Rainfall is stimulated by diminishing or cancelling the potential gradient existing between the ground and elevated zones of the troposphere and clouds by establishing an electrically conductive path between them.

Ore Concentration, R. B. Martin, Can. 187, 263, Oct. 29, 1918. Oxide ores are separated as oxides by employing in the pulp solution a sol sulfide in such a small proportion as will not convert even the surfaces of the oxide ore particles into sulfide in a flotation process with agitation and aeration.

Fertilizer, G. Borghesani, et al, Can. 187, 572, Nov. 26, 1918. Phosphoric material, potash material and $NaHSO_4$ is mixed and heated to fusion, the fused mass is then ground and is soluble in a 2 per cent. citric acid solution.

The Production of Dyes, W. W. Coe, Can. 187, 675, Nov. 26, 1918. A dye containing extracted coloring matter of plant substances of the banana class is obtained by treating the banana fruit substance with a hydrolising agent in the presence of a compound of one of the heavier metals.

Alcohol, The Acme Laboratories, Can. 185, 743, July 30, 1918. Lactic fermentation of whey renders the unfermented lactose therein susceptible to alcoholic fermentation. The lactose solution is then treated with saccharose in a state of fermentation to decompose the lactose with the saccharose.

Brick Baking Process, The Lambert Process Co., Can. 185, 692, July 23, 1918. Bricks are piled in a kiln, part of them are fired for a time with carbonaceous fuel and air is blown into the kiln to burn the remaining bricks.

Decolorizing Material, R. M. Catlin, Can. 186, 173, Aug. 20, 1918. Decolorizing material is produced by subjecting the residues from shale distribution to the action of HF.

Alcohol, Kellog Toasted Corn Flake Co., Can. 185, 862, July 30, 1918. Roasted or burnt starch is washed to dissolve out the soluble ingredients, the insoluble ingredients are converted into maltose and dextrines, the latter are inverted into fermentable sugars, the liquor is fermented and alcohol is separated out.

Light Reflecting Glass, C. J. Gundloch Can. 185, 232, July 2, 1918. A sheet of glass has minute depressions in one of its surfaces of such contour that the angle of refraction of these surfaces will not reflect the light back to its source and assembled in such number and relation as to diffuse the light passing through the glass.

Process of Calcining Granular Material, C. D. McCourt, Can. 187, 659, Nov.. 26, 1918. Granular material is continuously fed through a furnace chamber, an explosive gaseous mixture having combined with it a reagent capable of combining with the charge is injected at a speed greater than that of backfiring and accelerated surface combustion is effected within the charge to heat it and effect chemical changes. The hot combustion gases are passed through, the material being fed into the furnace.

Process of Heating Fusible Material by Surface Combustion, C. D. McCourt, Can. 187, 660, Nov. 26, 1918. An explosive gaseous mixture is injected into and through a fusible material at a speed greater than the normal speed of backfiring and effecting surface combustion of the explosive mixture in contact with the molten material which is agitated by the movement of the gases there through. The explosive gases contain a component capable of chemically combining with the fusible material. A modification shows the fusible material fed into contact with a bed of heated, refractory, combustion-accelerating material.

Process for Manufacturing Gasblack Hydrogen, etc., C. D. McCourt, Can. 187, 661, Nov. 26, 1918. Methane is forced through a highly-heated, porous and permeable bed of refractory material, where it is decomposed into gasblack and hydrogen, which are separated. The temperature of the bed is maintained by burning the hydrogen thus produced.

Process for Making Nitrogen and Carbon Dioxide, C. D. McCourt, Can. 187, 662, Nov. 26, 1918. Accelerated surface combustion of an explosive, gaseous mixture of fuel and air is effected, the CO_2 is absorbed from the combustion gases by contact with carbonate liquor and the nitrogen is separated from the decarbonated combustion gases. The CO_2 is removed from the carbonated liquor by heat and the liquor is returned to absorb more CO_2.

Molded Electric Conductors, J. P. A. McCoy, Can. 187, 645, Nov. 26, 1918. An electric conductor composed of a molded mass of pulverulent conducting material bound together with a binder containing at least one of a group of substances such as indene, cumaron and their isomers and polymerization products, is made by moulding the material with the binder and heating to expel nearly all the binder.

Motor Fuel, F. J. H. Rustige, Can. 187, 630, Nov. 26, 1918. A permeable container containing CaC_2 immersed into alcohol, the proportion of CaC_2 to alcohol being regulated so that the acetylene formed is dissolved in the alcohol.

Apparatus for the Melting of Iron, Steel and Other Substances Not Easily Reduced to the Molten Condition, F. G. C. Rincker, Can. 187, 627, Nov. 26, 1918. A furnace has in combination a chamber for converting liquid hydrocarbons into gas immediately on its entry thereinto, a superheater for the gas, an air heater and a combustion heater, with valves for control and means for cleaning.

Process for Assisting and Promoting Formation and Deposition of Aqueous Particles in and from the Atmosphere, J. G. Balsillie, Can. 187, 267, Nov. 5, 1918. A zone of the atmosphere is ionized and simultaneously a powerful electric field is established, thus causing the coalescence and deposition of the aqueous particles which have been condensed on the nuclei formed by ionization. Apparatus is also specified.

Process for Obtaining Water from Aqueous Particles in Elevated Regions of the Atmosphere, J. G. Balsillie, Can. 187, 268, Nov. 5, 1918. A powerful electric field is maintained about a collecting conductor supported in the elevated region of the atmosphere.

Apparatus for Depositing and Collecting Aqueous Particles from the Atmosphere and Collecting Rain and Dew, J. G. Balsillie, Can. 187, 269, Nov. 5, 1918. Parallel electrical conductors are supported parallel with the earth's surface and connected with a source of supply of uni-directional, high-tension electric current. These conductors are fitted with smooth-surfaced, straight wires and between them and the earth's surface is placed inclined catchment surfaces which are directed into a collecting vessel.

Method of Making a Composition for Welding and Cutting Metals, R. H. Brownlee, Can. 187, 637, Nov. 26, 1918. A hydrogen and hydrocarbon product is made by bringing a suitable hydrocarbon into contact with a highly-heated refractory material in an enclosing chamber in the absence of air and a suitable pressure in excess of atmosphere, the product is cooled to separate the hydrogen from the carbon and gases of the ethylene series may be added.

Dry Cells, C. Hambuechen, Can. 187, 416, Nov. 12, 1918. A cold solution of $ZnCl_2$ and NH_4Cl is prepared and mixed with a cereal, then the cold mixture is introduced into the container around the electrodes and allowed to gelatinize thereon. The electrolyte thus comes into direct contact with the Zn cup and the negative electrode, and no space is occupied by inert bibulous material.

Electrothermic Extraction of Zinc, E. S. Berglund, Can. 187, 453, Nov. 19, 1918. Several electric zinc smelting furnaces are connected to a common condenser in such a way that any furnace may be shut off. The zinc vapors are conducted during normal working from the furnaces to the common condenser.

Devices for Electrothermic Extraction of Zinc, E. S. Berglund, Can. 187, 454, Nov. 19, 1918. Electric smelting furnaces are connected to a common condenser through a chamber by vapor escapes, each of which may be shut off. Means are provided for heating the chamber.

Processes of Treating Ores, A. L. Pellergrin, Can. 187, 620, Nov. 26, 1918. $PbVO_3$ is separated from $PbMoO_4$ by sulfidizing the latter and submitting the mixture to flotation. The vanadate and molybdate may be removed from the other Pb minerals by sulfidizing the latter and submitting to flotation, then the $PbVO_3$ and $PbMoO_4$ may be separated as above.

Method for Producing the Zinc Chloride Solution of Cellulose, W. Ogawa, Can. 187, 349, Nov. 5, 1918. $ZnCl_2$ is heated to about 100° in the presence of an excess of $ZnCl_2$ sufficient to saturate the solution at the temperature attained. Cellulose is added and it dissolves in this solution in a very short time producing a practically colorless solution which gives a strong film or thread after coagulation.

Extaction of Lead, E. S. Berglund, Can. 187, 456, Nov. 19, 1918. Charges containing Pb are smelted in an electric furnace in the absence of air. The extracted molten Pb is collected in the furnace chamber and the Pb volatilized is condensed and collected.

A Process for Recovering Alkali and Other Substances in Cellulose Production, O. G. Stage, Can. 187, 316, Nov. 5, 1918. The strong black liquor is withdrawn from the cellulose digester and replaced with a weak liquor, which washes the pulp, then both the strong and weak liquors are transferred for burning under heat and pressure without exposure to the air.

Ethyl alcohol from Acetaldehyde. T. Lichtenhahn, Can. 187 609, Nov. 26, 1918. Ethyl alcohol is prepared from acetaldehyde by reducing the latter with hydrogen in the presence of a catalyst, the hydrogen used being in such large excess that heat of reaction of nearly 300 calories per kilometre of al-

cohol produced is carried away by the hydrogen, so that the temperature is kept constantly at that favorable for smooth reaction without decomposing the acetaldehyde.

Process of Making Base Exchanging Bodies, G. Rudorf, Can. 187, 428, Nov. 12, 1918. A solution containing silica and alkali is precipitated by an alkaline solution of alumina, the vapor portion of the mother liquor is removed and the unwashed precipitate is dried and immersed in water to cause granulation and washing.

Method of, and Tool for, Securing Connecting Parts of Battery Plates, I. M. Noble, Can. 187, 244, Oct. 29, 1918. The connector post of battery plates is secured to the battery cover by inserting the post through an aperture in the cover, then heating the part of the post above the cover to slightly fuse the metal and pressing the metal down around the edge of the opening in the cover. The tool for use in this process is specified.

Alloy, J. B. Grenagle, Can. 187, 017, Oct. 15, 1918. An alloy of 40 to 90% Zr with Fe is made by mixing materials containing compounds of these metals and co-reducing them to form the alloy. Ti or Al compounds may also be reduced with the other metals to give desired properties to the alloy produced. The alloy is used for incandescent lamp filaments, glowers, arcs, etc. It is non-corrosive and resists acids and may be worked.

Electric Extraction of Zinc, E. S. Berglund, Can. 187, 455, Nov. 19, 1918. Zinc powder collected in the condenser is subjected to a rubbing and compression action in the condenser. A screw conveyor in the lower end of the condenser forces the powder through an opening into a receiver.

Melting Furnaces, T. F. Baily, F. T. Cope, Can. 187, 423, Nov. 12, 1918. An electric furnace of the resistance type has a heating chamber, a hearth located in the bottom of the chamber, a circular resistance element located above the hearth and a roof, so arranged above the resistance element that heat rays radiating upwardly from the resistance element will be reflected upon the hearth, while heat rays radiating downwardly will strike directly upon the hearth.

Shaped Castings of Ferro Silicide, N. G. Petinot, Can. 187, 437, Nov. 12, 1918. Iron and quartz or sand are melted in an electric furnace with carbon which reduces the charge so that Fe and Si, which are properly proportioned, unite to form a compound containing 10 to 16% Si. The compound is poured while molten into molds, so as to produce acid-resisting castings. A mixer or holder is attached to the electric furnace for maintaining the temperature of the molten compound until sufficient material is produced for a complete casting.

Artificial Fuel, J. Schaub. Can. 187, 413, Nov. 12, 1918. A fuel consisting of cellulose, pentanitrate, Me, Alc. and Et Alc is made by dissolving in Me Alc cellulose having a nitrogen content, which renders it soluble, bringing the colloid to the desired viscosity by adding Et Alc and forming the colloid into a tubulous mass and injecting Et Alc into the tubules in the colloid.

Electric Furnaces, E. L. Crosby, Can. 187, 422, Nov. 12, 1918. An electric furnace has in combination a rotatable, refractory shell, a pair of travel rings engaging thereabout, though variantly spaced therefrom, a series of supporting rollers whereon the travel rings move, thereby turning the shell about a constantly variant axis, means for causing the rotative movement of the rings and electrodes adjustably engaging through the ends of the shell.

Matches, L. V. Aronson, Can. 187, 356, Nov. 12, 1918. The head of the match is ignitable by friction and contains $KClO_3$ one part, KNO_3 two parts, lamp black and P 60 parts, each and dextrine 20 parts, all covered with a suitable waterproof composition. This match is found very satisfactory for outdoor use.

CANADIAN PULP AND PAPER INDUSTRY.

The Dominion Bureau of Statistics has just completed a census for 1917 of the pulp and paper industry throughout Canada. Of the 80 concerns mentioned, 31 were engaged in the manufacture of pulp only, 26 in the manufacture of paper only, and 23 manufacture both pulp and paper. The total capital invested in this industry, including lands, buildings, machinery, stock on hand and working capital, amounted to $186,374,905. The total number of employees on wages was 21,356, on salaries 1,563, the total salary and wages bill amounting to $20,344,286. The aggregate value of production in 1917 was $96,248,834.

OIL CONCESSION IN ALBERTA.

A recent despatch from Ottawa states that the Government is considering a proposal to concede to the Shell Transport & Trading Company, Limited, the right to enter upon and develop all the oil-bearing lands in the Province of Alberta, north of the Athabasca River. This concession is to be in the nature of a monopoly for five years, except in so far as the rights of leaseholders and prospectors already on the ground are concerned. In return, the company is to pipe the oil to Vancouver, or to the head of the lakes, and after receiving six per cent. on its investment, is to divide the remaining profits equally with the Government.

BRITISH METAL BANK.

"Great Britain has authorized a metal bank to assist the metal and chemical industries. In the dye industry, not only research, but the industry itself, has been heavily subsidized. Over $5,000,000 has been advanced by the Board of Trade to British Dyes, Ltd., including $3,000,000 for building purposes and $750,000 for research. The import of dyes, except by licenses, has been prohibited for ten years after the war."—The Northern Miner.

The War Industries Board at Washington have refused the request of representatives of the steel industry to continue after January 1st the price regulation of their output.

DUTY-FREE INDUSTRIAL ALCOHOL.

The Cabinet Committee at Ottawa has endorsed the recommendation of the Advisory Research Council for duty-free alcohol for scientific, hospital and industrial purposes, and it is expected that at the coming session of Parliament, the restrictions now limiting the production and distribution of industrial alcohol in Canada will be removed. At present, the production of industrial alcohol in Canada is discouraged by the fact that all alcohol has to be sent to Ottawa to be denatured before it is allowed to be sold for industrial purposes, thus increasing costs by double transportation. In Canada, the annual consumption of alcohol for industrial purposes is about 1,000,000 gallons, at a cost of over $1 per gallon, as compared with about 50 cents per gallon in the United States, where Government restrictions on its production and use were removed some years ago. It is firmly believed that, after the removal of the excise duty and restrictions, alcohol for industrial purposes can be manufactured in Canada for less than 40 cents per gallon, by utilizing waste of the sulphite liquors of Canadian pulp mills.

Suggestions for Successfully Burning Lignites in a Domestic Furnace

By R. D. MacLaurin

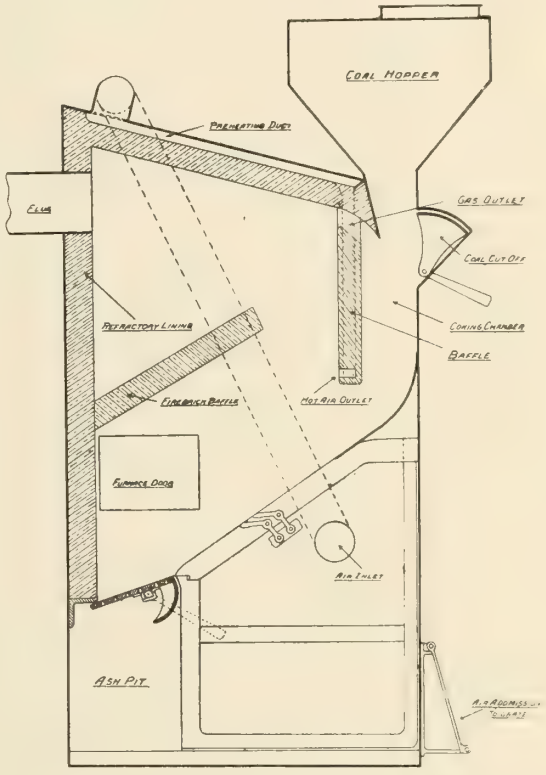
THERE has been a great deal of discussion in regard to the fuel situation during the past year, and the Government has endeavored to grapple with the problem of fuel production and distribution, but very little attention has been paid to the control of fuel by efficient methods of combustion. Nearly all the coal in Canada is burned directly in air, consequently the most efficient methods of burning fuel are of momentous, national concern, as it is generally conceded that twenty-five per cent. of coal is wasted through inefficient methods of combustion. This waste at $8 per ton would represent an annual loss in Canada of $60,000,000. It is also known that a very large percentage of the output of mines is lost to the mine operator in the form of screenings, as a profitable market is limited. Both of these wastes constitute serious economic problems, and, knowing these facts, a logical method of attack is to devise means for burning more efficiently fuels which are in general use, and also to develop methods for burning low-grade fuels which have not been used to any extent heretofore.

Western Lignites.

The lower-grade lignites have a high moisture content, and readily slack when exposed to the weather for any length of time. The slacking of the fuel has been a serious drawback to its general use, chiefly because facilities have not been available for storing and efficiently burning it, consequently it has been more troublesome to handle. Then again it is generally understood that coal greatly deteriorates in heating value when it has slacked, whereas, the facts are that the loss in heating value is a negligible quantity. To overcome these objections, attempts have been made to carbonize lignite, and briquet the residue. Carbonization undoubtedly is the most economical method of treating coal with high volatile content, providing economic conditions are favorable for the disposal of the by-products. However, the carbonized residue is an excellent domestic fuel, and can be burned with perfect ease and satisfaction in the proper design of furnace, so that there does not seem to be any real necessity for briquetting the carbonized residue and thereby adding additional cost to the fuel. It will be argued that, in order to burn lignite satisfactorily, it will be necessary to install new furnaces. That argument is correct, and it will be good business to install new furnaces, unless a domestic fuel can be put on the market considerably cheaper than anthracite ever has been in the past.

Value of Fuels.

The value of coal is too frequently determined on a B.T.U. basis solely. The number of B.T.U.'s per pound that coal contains is unquestionably an important factor, but it is only one. A knowledge of the quantity and constituents of the volatile matter of coal, as far as actual value is concerned, is more important than the number of B.T.U.'s it contains, as the constituents of the volatile matter are much more valuable for other purposes than for fuel. Also the nature of the volatile matter and fusion point of the ash are very important factors from the standpoint of complete combustion. The value of coals for heating purposes must be determined by the relative quantity of heat which may be obtained under operating conditions. A coal producing ash which clinkers badly may not be as valuable a fuel as one which forms no clinker and contains fewer heat units. The amount of combustible matter in the ash in ordinary furnace practice frequently exceeds six per cent. of the total weight of the coal. At the present time, certain people think that anthracite is the only domestic fuel at any price. If fuel costs, compared with anthracite, can be reduced forty per cent. by burning satisfactorily raw lignite or its carbonized residue, the probability is that the importation of anthracite coal will not continue many years.



It is recognized that most of the domestic furnaces which are on the market are not suitable for burning Western coals satisfactorily. It is true that lignite can be sluggishly burned in an ordinary furnace, providing one is an expert fireman. The chief objections to the furnaces in general use for burning lignite are:—

1. A large portion of the volatile matter passes up the chimney unburned.

2. A large percentage of the combustible matter finds its way into the ash pit.

3. Danger from explosions, due to lack of knowledge or care in firing, but, even when precautions are taken, the danger is not entirely removed.

4. Nuisance caused by soot and smoke.

5. Too much attention and time must be given to the furnace.

6. Furnaces are not adapted to burn screenings, or small coal.

Since most of the furnaces which are on the market are not suitable for burning our Western coals efficiently, it is obvious that furnaces should be constructed which will burn them satisfactorily. Mr. E. C. Hanson, Consulting Engineer, Winnipeg, some three years ago, recognized the vital importance of devising means for burning lignite coal efficiently. To accomplish this object, a system of arches was installed in the power plant at Saskatoon, and the results obtained have exceeded expectations. The principles which were established in the power plant were then adapted to a domestic furnace by Messrs. Hanson and Cowley, and the furnace was thoroughly tested out by the writer during the summer of 1917.

The essential features of a furnace for burning lignite or its carbonized residue are:

1. Carbonizing chamber.
2. Combustion chamber.
3. Introduction of hot air into combustion chamber.
4. Inclined shutter grate so constructed that screenings and dust are prevented from escaping into the ash pit.
5. Coal hopper of sufficient capacity to keep furnace operating twenty-four hours on two charges.
6. Dumping grate so constructed that ash may be dumped while live coal is retained on inclined grate.
7. Rear arch inclined so as to reduce temperature on fuel bed, and thus prevent, or at least greatly reduce, the possibility of clinker formation.
8. Constructed so that coal will be readily ignited and burn continuously, thus maintaining a uniform temperature over a long period of time.
9. So constructed as to prevent the possibility of soot or smoke forming.
10. Precautions taken to have a thorough mixture of combustible gases and hot air, thereby attaining complete combustion and remove all danger from explosion.

Operation of Furnace.

A wood fire is first kindled on the horizontal portion of the grate, and then coal of pea size is gradually added to the hopper until the grates are covered to a depth of about four inches. The depth of the coal in the fuel-bed can be regulated by the gate at the bottom of the hopper. The coal is readily ignited, and, as the flame passes up over the surface of the inclined fuel-bed, it becomes red hot in the course of thirty to forty-five minutes. The feeding of the furnace is automatic with coal of pea size. Practically all the Western coals have been burned satisfactorily, and no difficulty has been experienced with the gravity feed. It is not desirable to use coal of stove or nut size, as the free movement of the coal down the hopper is retarded, but coal of pea size or screenings gravitates without interference.

The time necessary to devote to a furnace is an important factor. One of the serious objections to most of the furnaces is, that it is necessary to fire frequently during the day and night. With this new furnace, it is found that a good fire can be maintained continuously in the furnace by filling the hopper twice in twenty-four hours. This point was established with Souris coal, as it is generally considered to be one of the lowest-grade fuels. Fire has been maintained in the furnace with Souris coal for eighteen hours without attention, and relighted by dumping the ash and adding fresh coal.

In burning the various Western coals, no trouble was encountered with the formation of hard clinkers. In our earlier experiments, the rear arch of the furnace was parallel to the fuel bed, and, with one example of coal in particular, hard clinker was formed, but it was found by tilting the arch slightly upwards and increasing the space between the arch and fuel bed that the tendency to clinker formation was considerably reduced. With the furnace as at present constructed, the clinker which does form from Western coals is of a very porous nature and is easily disposed of by the dumping grate.

Dumping the Ash.

The temperature on the dumping grate is lower than that on the inclined grate, and after the fire has been burning all day, the ash becomes comparatively cool, and may be dumped without loss of live coal. The dumping grate carries a circular plate attached to its lower side in close proximity to the shutter grate, so that when the dumping grate is inclined forward, the ash falls into the ash pit and the circular plate prevents the hot coal from gravitating forward into the ash pit. A number of different forms of dumping grate have been experimented with, but the form as described works most satisfactorily. The best burning results are obtained by keeping the hopper supplied with coal, regulating the air mixture, dumping the ash when it forms, and avoiding shaking the inclined grates.

How Air Is Supplied.

Air is admitted to the fuel-bed chiefly through the dumping portion of the grate, which is perforated with one-quarter inch holes. The steps comprising the inclined grate overlap each other and fit very close together, so that the air spaces are very small, consequently, most of the air which passes over the fuel bed is taken in through the dumping grate. The best results were obtained with a limited air supply through or over the fuel bed, and just sufficient air was admitted at low velocity to gasify the coal. The combustible gases were burned in the upper chamber by introducing hot air into the lower part of the combustion chamber at approximately the same temperature as the gases. Under these conditions, a very thorough mixture of air and combustible gases is secured, and consequently complete combustion.

Perquisites for Efficient Combustion of Western Coal.

1. *New Furnace Design*:

Furnace design of such a nature that combustible in the ash will be reduced to a minimum, and also to prevent the escape of combustible gases up the chimney. In general practice, the amount of unburnt carbon in the ash varies with different fuels, furnaces, operators and fusion temperature of the ash, consequently, uniform combustion results are very difficult to obtain, if not impossible. With the furnace as described, more uniform results can be secured by any operator, and combustion is as nearly complete as can be obtained by burning fuel on grates.

2. *Control of Combustible and Air*:

The control of combustible and air in a domestic furnace is a very difficult problem. Whenever fresh coal is added to the fire, the temperature of the furnace is lowered, and a large part of the volatile matter of the coal escapes up the chimney before the temperature of the furnace is again high enough to ignite the gases, and further, the mixture of the air with the gases is very imperfect. In this new

type of furnace, the carbonizing and gasification of the fuel is gradual and continuous as the feed is automatic. The fuel bed on the inclined grate is always red hot, and thus a high temperature in the furnace is maintained. By introducing hot air under control into the combustion chamber, complete oxidation of all the volatile matter is obtained. Burning tests have been conducted on practically all the Western coals marketed, and the fuel can be burned so that no carbon monoxide or hydrocarbons are found in the flue gases. Using Pembina coal, the average percentage of carbon dioxide during a three-hour period was 16.2 per cent.; the maximum percentage of carbon dioxide was 17.3 per cent. These results indicate very complete combustion of the volatile matter, and it was found that the combustible in the ash, particularly from Souris coal, is practically negligible. The temperature in the combustion chamber from Souris coal reaches a maximum of 2,100°F. Other Western coals give higher temperatures.

In April 30th number of "Power," an experimental lignite furnace for domestic heating is described by Kreisinger, of the Bureau of Mines, Washington. In his article on "Combustion of North Dakota Lignites, With Suggestions for Design of Furnaces," he states that "In fact, it seems that the carbonized residue when burned in this special type of furnace would make an ideal fuel for house heating purposes." Since the furnace described by Kreisinger is in many respects similar to the original furnace patented in Canada and the United States over a year ago by Messrs. Hanson and Cowley, and, having conducted a large number of burning tests with this furnace, it may not be amiss for the writer to discuss the relative merits of the original furnace—which was similar to the one Kreisinger described—and the new design. From the writer's experience in operating the two furnaces, the new design has several practical advantages over the original furnace:

Firstly—The easy disposal of the ash without dumping the fire is an important consideration.

This was found difficult with the horizontal dumping grate in the original furnace. If the fuel bed on the inclined grate remained in position until the ash was dumped, there was no particular difficulty except when clinkers formed. When agitating the grate to break the clinker, there was sufficient vibration created to start the fuel gravitating on the inclined grate, which, of course, was not desirable. After experimenting with a number of different forms of grate, the lightly inclined dumping grate carrying a circular plate has proved satisfactory, as it greatly facilitates the dumping of the ash and clinker.

Secondly—It was found that when the rear arch paralleled the fuel bed too closely, there was a greater tendency for clinker formation than when the arch was removed farther from the fuel bed and tilted slightly upwards. As the flame passes over the surface of the fuel bed, it is directed upward and away from it, so that the heat is not reflected to the same extent. The clinker always forms on the surface, so any device which will tend to lower the temperature at the surface of the fuel bed, below the fusion point of the ash, will assist in the prevention of clinker forming.

Thirdly—Air introduced through the grate and coal hopper is difficult to control. By allowing a limited amount of air to pass through the grate, and then conducting hot air under control into the lower part of the combustion chamber, it was found that the fire could be regulated with greater ease. By mixing the combustible with hot air, the second stage of the combustion is more complete within a shorter space than was experienced in the original furnace.

Fourthly—The exit flue for the gases has been changed from the top to the upper end of the combustion chamber. This alteration was made so that air could be pre-heated in a space above the combustion chamber, and, furthermore, the gases have a greater distance to travel, which makes it easier to control the length of flame. As the boundary of the flame signifies the zone of combustion, the completion of the oxidation is readily determined. The length of the flame depends on the thoroughness of the mixing of the air and gases, and also on their velocity. However, in the new furnace no difficulty was experienced in confining the flame to the combustion chamber and still maintaining high temperature. With a short flame and low velocity of the gases, there is little tendency for the fine ash to be carried into the flue.

Fifthly—As far as the position of the hopper is concerned, there is no material difference in the two furnaces as one delivers the coal just about as readily as the other. The hopper on the new design is kept air tight, which has proved an advantage in regulating the air supply and, consequently, controlling the fire. The air tightness has further proved advantageous in maintaining a lower temperature in the hopper, and preventing the escape of gas. Certain coals may be burned continuously, and the hopper remain quite cool, while with others it becomes slightly warm, though no practical difficulty has been experienced with the coal igniting in the hopper as the air tightness minimizes such a possibility.

Summary.—The object of this paper is merely to present such facts which may establish the practicability of successfully burning low-grade fuels, or their carbonized residue, in a new design of domestic furnace.

MANITOBA CHEMICAL SOCIETY NEWS.

The Manitoba Chemical Society held its first meeting of the season in the Science Building of the Manitoba University, Tuesday evening, December 10th.

The officers of the Society elected for the current year are:—

Secretary: Dr. J. W. Shipley, Chemistry Department, Manitoba Agricultural College.

Treasurer: E. L. C. Forster, Laboratory of Inland Revenue.

Committee: Prof. M. A. Parker, Chemistry Department, University of Manitoba; F. Pugh, Research Laboratory, The T. Eaton Company; Dr. F. J. Birchard, Dominion Grain Research Laboratory; A. Blackie, City Chemist.

Mr. F. Pugh, head of the Research Bureau of T. Eaton Co., gave a paper on the Microscopic Analysis of Textiles, illustrating the address with projection slides, showing the characteristic appearance of the various fibres making up textiles. The address very ably showed the application of scientific principles and apparatus to the examination of any kind of textile material and in particular the use of the microscope in detecting and distinguishing the fibres of cotton, silk, wool, jute, etc.

The next meeting of the Society will be held early in the New Year, when Dr. Shipley will give a paper, illustrated with lantern slides, on the Chemistry of an Alaskan Volcano.

CONSERVATION OF FUEL.

By J. Stephenson.

CONSERVATION, under war conditions, has become part of our existence in both domestic and industrial life. In many cases, it has been the mother of invention; the pioneer in the opening of new fields, and the parent of standardized methods under which we live. We have endeavored to eliminate waste in every form, and provide substitutes wherever possible, with the results that many have proven to be not only economical, but to the benefit of mankind. In the midst of these national improvements, we are yet shrouded with a gigantic waste in the combustion of coal, in which there has been little or no improvement.

In the industries, the pulse of the works is its source of power, which invariably is supplied from the combustion of coal in some form or other. In the commonest way, it is supplied by the generation of steam from the combustion of bituminous coals. In modern and so-called efficient designs of steam-boilers, it is only possible to convert from 20 to 25 per cent. of the total heat value of the coal into steam power. This condition has long been a source of discussion, and designs of stoking machinery, smoke consumers and other devices intended to obviate this great loss are innumerable.

Combustion.

The failure of these devices is due to various reasons, of which the following is the most important: "The great variation in the nature of the gases evolved at different stages of the decomposition of the fuel." The nature of different fuels and total heat units capable of being evolved varies considerably, and the rate of evolution of gases is accelerated or depressed according to temperature and barometric conditions. The proportion of oxygen required for the combustion of carbon is 2 to 1 respectively, and that required for the combustion of hydrogen is 1 to 2 respectively. The volume required for an hydrocarbon is relative to these according to its density. When a charge of raw fuel is put on a hot fire, the volatile matter or hydrocarbons are immediately driven off at a rate at which it is impossible to completely burn them without the employment of forced draft. The carbon residue which remains burns locally with two atoms of oxygen and requires only natural draft. It is impossible, under these conditions, to maintain a correct volume of air at all times, the result of which is either a large loss of combustible matter by insufficient or a considerable cooling of the furnace setting by excess when the carbon only is being burnt.

Coke.

In finding a remedy for this great loss of fuel, it appears to be in line that before we can successfully construct apparatus to handle fuel and obtain the greatest evolution of heat, it is first necessary to standardize the raw fuel by concentrating it into a fuel of homegenous structure. This may be accomplished by the coking and briquetting processes, each of which have their special advantages. The use of artificial gases exclusively for domestic purposes is desirable, owing to its cleanliness and convenience, but, under present conditions, its cost per heat unit is higher than other grades of fuel, and the only hope of a substantial reduction is increased consumption. An increase in the consumption and manufacture of gas simultaneously increases the manufacture of coke, which enables a greater use in the industries. A reference to the following statistics, which is the official compilation of the U. S. Geological Survey, is evidence of the development of coking processes. This represents pre-war conditions, on which it is advisable to base out prospects of future development.

Year.	Coke Ovens.	Coal Used. Short Tons.	Coke Produced Short Tons.
1880	12,372	5,227,741	3,338,300
1885	20,116	8,071,126	5,106,696
1890	37,158	18,005,209	11,508,021
1895	45,565	20,848,323	13,333,714
1900	58,494	32,113,553	20,553,348
1905	87,564	49,530,677	32,231,120
1910	104,440	83,008,327	41,708,810

Artificial Fuels.

The manufacture of artificial fuels or briquets is also a field in which great advancement can be made, in that it enables a number of lower-grade fuels to be mixed with those of greater density and consolidated into a fuel which may be moved without breakage and minimum transportation cost.

It has been proven by geologists that the natural fuel which we term "coal" originates from vegetable matter, and has solidified into its present form by the pressure and temperature of the earth. In order to produce a fuel of uniform structure in a like manner, it is necessary to subject the lower-grade fuels, such as lignite, peat, wood, turf, domestic garbage, and other organic matter, to artificial means by which their original composition and physical properties can be broken up, and a carbon residue consolidated into a substance of standard quality. The standardization of fuel would enable its employment in the industries to be made under definite conditions of air supply so necessary for complete combustion.

(To be continued.)

FACULTY OF RESEARCH.

In a recent address to the University Women's Club, Sir John Willison referred to the urgent necessity of establishing at the University of Toronto a faculty of research in the natural sciences, in view of the proposed schemes for the application of science to manufactures and industry. The research work that has been undertaken by Great Britain, the United States and other countries will require all of their men for their own purposes, and it will, therefore, be necessary that means be provided to have our own men properly trained in order that they may be ready to supply the staff of the proposed Institute of Research at Ottawa. The staff of such a faculty would consist of research men, devoting their entire time to advanced work, in no way connected with the teaching of junior college work.

RE-ORGANIZATION OF IMPERIAL COLLEGE OF SCIENCE.

In order to meet the requirements of the post-war situation, the Imperial College of Science, London, England, propose to re-organize their department of chemical Technology, so as to include four new sections—fuel technology and chemistry of gases, with refractory materials; chemical engineering; electro-chemistry; technology of carbohydrates, fats, oils and rubber. The additional expenditure required for buildings and equipment in connection with these developments is estimated at £100,000, with not less than £10,000 a year for maintenance and working expenses.

SEMI-SCIENTIFIC SIDELIGHTS.

By C. H. Wildridge.

But all the time he still pursued
(With splendid nasal fortitude!)
His studies in the mystic lore
Of things like $H_2 SO_4$,
Combined his chemical researches
With a fierce hatred of all churches,
And only left his stinks and smells
To read the works of H. G. Wells.

F. R. Burrow.

I AM not acquainted with the gentleman who wrote the above. I wish I was. He has, as a Yankee would put it, the situation "pat." Perhaps "had" would be a better word to use because, in these days, we see so many "near" chemists that I am afraid the old traditions of 1914 and before have almost passed out of our ken. In those days, one could quote the poet without feeling that one was side-stepping Truth. One could truly say:

"A smuggy scug, he walked alone
And science marked him for her own."

Later, however, it has been necessary to supplement the ranks and some of the recruits know more of boot soles than those of Bishops. It may be unfortunate and it *is* disconcerting. One cannot talk "Wells" to such folk. They prefer Mary Pickford and Douglas Fairbanks. Such being the case, they have no place in this article. It is only for the real, sure-enough chemist and his doings in that out-of-the-way, smelly, little corner of his, which is often dignified by the appellation "laboratary."

No one has even undertaken to write anything in which the chemist—the analytical chemist, and not the blue-and-orange-shop-window-bottle kind—has ever appeared, except as a be-spectacled and be-whiskered, deaf, but quite the reverse of dumb, half man and half ogre, who worked in unknown ways and among unknown things. It's all a huge mistake—in reality. I've met several of the brand described above, but, as a matter of fact, they are distinctly in the minority. Most chemists are still the same as when Pope, wrote his lines on "the starving chemist and his golden ways"—the golden referring to his dreams and not to his remuneration. Most of us are starving in one way or another. The beefy, well-fed looking chemist has yet to be found! In these days of war and Huns and manifold other curses, we are tolerably well satisfied to find a half hour somewhere between eleven and three in which to absorb the contents of a small, but convenient, package which our beloved (?) landlady was kind enough to place at our disposal in the wee hours, when we breakfasted, and which has to maintain our physical selves in a normal state of efficiency until dinnertime arrives. Needless to say, we don't get fat on such truly war-time rations. It has often struck me what a blessing it would be to the chemist if he could find an elixir of life which might be passed into the system at stated intervals, by means of a hypodermic needle. The only objection I should have would be that one would not, presumably, have the relish for an after-dinner smoke that one has at present. What a time saver it would be, though, in these days of steel-makers who can't make steel, of Government inspectors who can't inspect but only "expect," of Assistants who might be better described by the first syllable of their title, and of chiefs who insist on "chiefing" to an abnormally unnecessary extent. I cannot help thinking that the Kaiser has a tremendous amount to answer for when I think of the mornings I have risen at 7.00 a.m., of the fifteen-minute lunch hours, of the indigestion which must naturally follow, of the very late dinners, of the night work, the Sunday work. My heavens! if the Kaiser realized these things half as much as some of the chemists do, he would be glad to take a dose of cyanide to end his remorse.

It it wasn't for Little John and Jimmie, I couldn't stand it personally. Little John is one of our men, so called because he is well over six feet tall. Jimmie—well, Jimmie is a conundrum of the Scottish persuasion, an infallible test for ammonia and generally a rotten sort of a nuisance. I think Messrs. Moody and Sankey must have been his joint god-fathers, because he has a never-ending fund of their songs and yells with him, and they will keep coming out—that's the worst of it. He is almost as bad as the organ grinder who comes around, like market days, every Tuesday and Friday, to play the Marsellaise, the Maid of Athens and the Toreador song. That chap has a classical vein in him, probably in the region of his pedic extremities.

To return to Jimmie (not that I ever should, if I could ever get away from him). He usually enters the sacred precincts of the laboratory about 8.15 a.m.—as Little John says, 'with a loud and greivous noise"—sings, whistles, cackles, yells, hollers and otherwise maltreats Moody and Sankey until nine o'clock and then moves off mechanically to the tune of "The British Grenadiers" to the receiving department. Shortly after, he returns with about twice as many samples as constitute an ordinary day's work, and then has the inexpressible temerity to ask me what I shall do if he brings in as many more in the afternoon. This usually brings on a storm of what might well be called "war language." (I understand that the chaps at the front are becoming experts in handling language usually used when one finds it necessary to open "the safety valve," and, of course, their confreres behind the guns must keep up some sort of a reputation!)

The work for the day is now well under way when one of the men, one of the new variety—I can't mention his name, but a namesake of his was shot a while ago for proclaiming himself president of the Irish republic—walks in. Of course, in the interest of discipline, I ask for an excuse and am usually told that the alarm clock for the landlady failed to bring him from the arms of Orpheus at the right time. I mildly remark that an earlier retirement from the "Orpheum" on the preceding night might have been a help and let it pass. He's not a bad sort, and men are too scarce to risk too much. A sudden murmur from the other end of the laboratory calls attention. Little John is in trouble, and is proclaiming to the world at large and the laboratory in particular that "this war is a ——." One of his manganese determinations has upset and that means more work. A low staccato throbbing breaks forth from the sulphur table. Ross, the chap who is handling them, is up at the other end of the laboratory and returns in time to hear a squeal of victory as the syphon does its work and undoes his. Ross's epithets do credit even to a man from Glasgow.

My telephone rings in a most imperative way. On answering it, I find one of the inspectors is very anxious to have the analysis of a couple of samples. A search through my records fails to reveal any such, and I finally obtain an apology from him—they are still on his desk.

Just then the chief arrives with a visitor. Will I please show him round and tell him something of our work? To

be sure. I feel as generous as the man in Kipling's "Paquett M.P." I shall try and detain him until the silicons fume. He glances at my table of electrical apparatus and expresses mild amazement that it is possible to melt steel in such small furnaces. They must be hot. Of course. I tell him they are, and we help them by running oxygen through at the same time. "Oh!" says he, watching the bubbles. "I thought the water in those tubes was boiling. It is really most interesting!" No doubt, I think, and pass on to the fume cupboard. Fine! Our silicons are just fuming nicely. He gets a whiff and starts to cough. His interest is lost, but the cough persists and he retires to the office, vowing that he does not see how we live in such an atmosphere. I tell him it is good for consumptives and will kill the bacteria in his throat, but he seems doubtful. and so I return to my own affairs.

It is just about time for lunch. Little John is getting out his "nose-bag," and I smell the coffee as it boils on the hot-plate. We gather round the table and tell stories for half an hour in between bites. Little John had some good ones about a Yankee, named Jones or Brown or some such name, who always called cement "seement," and vowed that Germany would be able to beat the world. Another has some stories from the survey gangs, another from the medical schools, a third retails romance from the Clyde, and so on until our time is up. Then it's work again.

And so we go on, plenty of work, work of a nerve-racking sort, and just a little play. Hours are no significant part in our programme. The clock has little or no meaning for us, except when we must time the boiling of some solution or other.

The work has its rewards, however. They are not necessarily monetary, but rather sentimental. Sometimes one dreams over one's pipe before retiring, and in my dreams I see through the haze of the laboratory smoke and fumes, the giant we are helping to create—the steel colossus that must hurl the Hun back to his own place—Averno. And then the figure changes to that of Peace—peace armed with the sharp sword of scientific endeavor and enlightenment, and I think of those days to come, when the old lion of the British Empire shall once more be at peace and live again the gentle overlord of the world. Then it is that Kipling's words come back:

"God of our fathers, known of old,
Lord of our far-flung battle line—
Beneath whose awful hand we hold
Dominion over palm and pine—
Lord God of hosts, be with us yet,
Lest we forget—lest we forget."

DEAD BURNED MAGNESITE.

THE value of magnesite as a refractory material depends on the high melting point and the resistance to chemical action of magnesia. Pure magnesia is not suitable for general refractory purposes and a certain percentage of iron oxide or iron oxide and silica must be present in the magnesite, so that in the subsequent dead burning of the crude rock, they will effect the necessary sintering and act as a bond to hold the grains together.

When used for making furnace bottoms, some magnesites require the addition of slag to lower the melting point further; this practice can be eliminated by using a magnesite containing the necessary quantity of iron oxide and silica to give a particular degree of refractoriness.

In a dead burned magnesite, containing no lime, the iron oxide and silica are combined with magnesia. Now lime is more chemically active than magnesia and has a greater affinity for iron oxide and silica. When lime is mixed with magnesium compounds of silica and iron oxide, it will attack them under the influence of heat. Lime compounds of silica and iron oxide will be formed and the magnesia will be set free. This explains the disintegrating action of basic slags and limestone on magnesite furnace linings and bottoms.

If the necessary iron oxide and silica in the magnesite are already combined with lime, instead of magnesia, the chances of disintegration of the magnesite are lowered to a minimum. These lime compounds are neither acid nor basic: they are neutral and, therefore, increase the power of resistance to all corrosive agents.

The necessary amount of lime is comparatively high. But it will not be present as free lime, such as is found in burned dolomites and badly-burned or badly-prepared magnesites containing lime. Free lime is harmful. Dolomite contains too much lime to permit of sufficient iron oxide and silica being present to combine with all the lime. The product would have such a low melting point that it would be useless in the metallurgy of steel.

In the preparation of this particular magnesite in which the silica and iron oxide are rendered inert, continual chemical supervision is necessary. The raw materials must be analyzed to insure uniform refractoriness and the lime controlled so that there will be just sufficient to satisfy the iron oxide and silica. Fine grinding and intimate mixing of the raw magnesite are essential points. The use of rotary kilns insures uniform temperature and dead burning.

The dead burned product will not slacken in air. It will be highly refractory, will resist the corrosive action of slags, limestone and metals, and when used for furnace bottoms, it will bind into a solid mass without the addition of any other material.

The Scottish Canadian Magnesite Co., Ltd., of Hull, Que., is utilizing the plant of the Canada Cement Co. and is treating magnesite rock from Grenville, Que. The lime content of the rock is controlled at the mine, so that the lime in the finished product runs 16 to 18 per cent. Owing to the absence of iron in the Grenville magnesite, about 5 per cent. of iron ore is added to the charge, which is ground to a powder—95 per cent. to pass a 100-mesh screen. The ground charge is burned at a temperature of 1,650° to 1,700° C. in rotary kilns. The dead burned magnesite is shipped in grains of ⅜ inch and under to the steel companies of Canada and the United States, and is used largely on furnace bottoms. The product is considered as good as the Austrian or Grecian magnesite, and its high lime content seems to contradict the generally accepted theory that high lime in magnesite is bad.

SALT EXTRACTION BY ELECTRICITY.

"Conservation," a monthly bulletin published by the Commission of Conservation, Ottawa, states that successful experiments have been carried on in Norway with a view to extracting salt from sea water by means of electricity, and that two factories are shortly to be started for this purpose—one in western, the other in northern, Norway. Each factory is calculated to produce 50,000 tons of salt per year.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa.

(Notice.—Recent Government publications of scientific, technical or educational value, are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

Department of Trade and Commerce.

Food and Drugs Laboratory. Bulletin 414. Lard and Substitutes. One hundred and ninety-one samples of lard and lard substitutes were examined by Mr. J. A. M. Dawson, B.A., Analyst-in-charge at the Vancouver Sub-laboratory, and this bulletin contains his findings in the form of a monograph on the subject, of which the Chief Analyst says, in his introductory remarks: "I do not know that anywhere in our literature is to be found so concise, and at the same time, so full a treatment of the question." Four samples were found to be adulterated and are included in the report. Of the 191 samples, 68 were sold as lard and 123 as substitutes, which represents an increase of 29 per cent. in the number of substitutes, when comparison is made with a report published by these laboratories in 1914 on the same subject. (Bull. 274.) Only one sample of lard was found to be adulterated; it was a cotton-seed oil product. Mineral oils, whale oils and fish oils were absent from all samples. The subject is discussed at length under the headings: Composition, Rancidity, Methods of Inspection, Improvements in Tests, Calorific Values and Claims of Food Values. The arguments for and against the use of whale oil as human food are given. It is suggested that the source of the oils and fats used in the manufacture of the substitutes should be declared. Trade relations in regard to vegetable oils and the necessity of developing new sources of edible oils are considered. Altogether the report shows the results of a careful and thorough investigation, and it is probable that it will have a wide circulation throughout Canada.

Bulletin 417. Manufactured Cattle Feeds. 6 pp. One hundred and nine samples were collected and analyzed. Feeds of this nature are required to bear a registration number and a guarantee of feeding value. Nine were sold without a guarantee, and are consequently subject to penalty. Ten more were collected by mistake. Eighty were found genuine and ten are below their claims in feeding value. Four others contain weed seeds in excess. A new feature in this publication is that none of the analyses of the genuine samples are recorded. This makes for economy in printing, and where the subject is a police inspection, such as this, the practice is desirable.

Commercial Intelligence Branch.

Weekly Bulletins, 774-777. These interesting little weeklies continue to bring to their readers news of the foreign markets, in which Canadians may be interested. In 774, British Honduras, Italy, Japan and the Argentine are especially mentioned. The war-trade orders affecting Canada are still given a place. The removal of the restrictions on the use of platinum is announced. Trade with the Argentine is being given considerable attention in these papers, and it seems established that quite a volume of trade could be worked up between this country and the Argentine.

In a review of Britain's trade with the principal overseas countries during the first nine months of 1918, it is shown that imports from Canada amounted to 82 million pounds sterling, as compared with 42 million pounds for the same period in 1916. Complete tables are given.

The mining output and requirements of South Africa are reviewed.

Hong Kong is indicated as a market for Canadian beer, and tinned milk—the latter being asked for in the form of evaporated skim milk, thickened, and made very sweet. The present time is indicated as opportune for the introduction of new brands of these commodities.

Prospects for marketing molybdenum concentrates in the United Kingdom are discussed in No. 775, in which it is pointed out that "there is likely to be a fair and increasing demand for molybdenum, and . . . that producers should have no difficulty in marketing reasonable quantities." Australia and Norway will be the chief competing sources of supply, the product of the former country being high grade—90-95 per cent.—molybdenum sulphide.

Canadian carbide exports to Australia have fallen off during the past year.

Moving pictures of Canadian shipbuilding have been made by the Exhibits and Publicity Branch of the Trade and Commerce, and will be shown in every country in which Canada has trade commissioners.

Dominion Bureau of Statistics—Monthly Bulletin of Agricultural Statistics, October. An item of interest to chemists in this issue is a review of "Milling and Baking Tests of Canadian Wheat, 1918," by the Dominion Grain Research Laboratory of the Trade and Commerce, at Winnipeg. Dr. F. J. Birchard states that the inspection made of representative samples of Canadian wheat shows that "the first four grades may be regarded as practically of equal value, and that Grade 6 is very nearly equal to Grade 5. The laboratory has never before, until this year, examined average samples of the different grades which showed such slight differences, both as regards milling and baking quality."

Department of Interior.

Dominion Water Power Branch—Annual Report, 1916-17. 106pp. Reports are presented by the Superintendent, the Chief Draughtsman, the Accountant and the Chief Hydraulic Engineer. The work of the B. C. Hydrometric Survey and the Manitoba Hydrometric Survey is detailed. Alberta and Saskatchewan Power and Storage Investigations take 15 pages and the work of the Dominion Water Power Branch, in co-operation with the Nova Scotia Water Power Commission, is outlined. Twenty maps and plans accompany the work, and the report on reclammation completes the issue.

Natural Resources, Intelligence Branch. "The New Manitoba District—Its Resources and Development. 44pp. By F. H. Kitto, D.L.S. Those who have read the Peace River Report will want to see this little treatise on the resources of this bit of new country. Mr. Kitto seems to enjoy describing these new places not less than he does living "on the trail" and in the canoe seeking the information, which he so well sets down.

Department of Mines.

Geological Survey—Maps:

1. The Ontario Peninsula.

2. The Niagara Peninsula.
3. The Bothwell-Thamesville Oil Region, Kent County, Ontario.
4. Burnthill Brook Tungsten Area, York County, New Brunswick.

Summary Report, 1917, Part E. 48pp. Two maps. The subjects of this summary are:

1. Canadian Northern Ry., between Nipigon and Longuelac, Northern Ontario.
2. North Shore of Lake Huron, Ontario.
3. Montreal River District, Northern Ontario.
4. Oil Prospects of South-western Ontario.
5. The Ohio Shales of South-western Ontario.
6. Graphite in Port Elmsley District, Lanark Co., Ont.
7. The Arnprior-Quyon District, Ontario and Quebec.
8. Chromite in Quebec.

Summary Report, Mines Branch, 1917. 154pp. Following the Director's General Report on the work of the Mines Branch for the year, there are individual summary reports, under the following division heads:

Metalliferous Mines.
Non-metalliferous Mines.
Fuels and Fuel Testing.
Ore Dressing and Metallurgy.
Road Materials.
Ceramics.
Chemical.
Mineral Resources and Statistics.
Draughting,

and a report of the operations of the Dominion of Canada Assay Office at Vancouver.

THE ORGANIZATION OF CANADIAN CHEMISTS—A PLEA FOR A DOMINION-WIDE NATIONAL SOCIETY.

By Dr. Frank T. Shutt, Chairman, Ottawa Branch, Canadian Section, Society of Chemical Industry.

Gentlemen.—My first words to you must be those of thanks and appreciation for the honor you have conferred upon me in electing me your chairman for the ensuing year. Many of you are, in person, upknown to me, but my sincere thanks are to you all—old friends and new friends alike. Of late years, and more particularly since the outbreak of war, the oportunities to meet my fellow-chemists of the capital have been few: I am looking forward with pleasure to our meetings this winter, as offering excellent opportunities to "get together." I trust before our year is over we shall know one another better, both socially and professionally.

Although the Ottawa branch of the Society of Chemical Industry was organized towards the close of last season, we may fairly say that we are to-night entering upon our corporate existence. Your Committee, and I am sure all of us, are very anxious that this first year in our history may be a very successful one, for a good beginning will go a long way towards putting this branch on a permanent basis. May I be permitted to emphasize one or two factors which I consider are essential to the success of our meetings?

The first is a good attendance. Nothing is more discouraging, nothing more effectually dampens enthusiasm than a poor attendance. Numerically, at the outset, we shall not be a strong body, and it will, therefore, be all the more necessary that every chemist in Ottawa should feel it incumbent to be present at the meetings. We shall also welcome all who may have an interest in the proceedings and in this connection we might ask you to invite those of your friends interested in chemical matters.

Secondly, there is the matter of the programme. Your Committee has arranged a provisional programme for the season, which promises to be interesting and attractive. It may, however, be necessary to make one or two changes —the times are so uncertain and unsettled—and in that event, we shall look for volunteers among our members. There is no lack of excellent talent among the Ottawa chemists, and I know there is a large amount of valuable chemical work being carried on here. It will be the chief object of our meetings to make this work known. Let us in this matter of programme learn to depend on ourselves. Let each one determine and plan to do his part in this matter, and we may have programmes fully equal in interest and value to those which our older sister branches in Toronto and Montreal have had for some years past.

May I add a further word to emphasize the importance of discussion—a well-ordered discussion—at the close of the papers. Discussion not merely adds life to a meeting, but is frequently the means of contributing additional data, additional information, fully as important as that presented in the paper. I shall look for the discussion to form an integral and important feature of the programme, and I trust that no diffidence will prevent you from doing your part in this matter.

The Organization of Canadian Chemists.

Your Committee has selected as the subject for our consideration to-night the organization of Canadian chemists. This is probably the most important matter of a general character that could engage our attention at this time. Many of us I know are of the opinion that the time has fully come in the history of Canada, when, alike in the interests of ourselves and of our country, there should be a closer linking up of the chemists at work throughout the Dominion. We all recognize the basic character of the relation that exists between the science of chemistry and our national manufactures and industries, and we are all firmly convinced of the vital importance of the application of chemistry to their development and welfare. The same is also true in respect to chemistry and our great natural resources. Chemistry must play a very large and important part in their future economic development. Of agriculture, Canada's largest and most important industry, from an experience of more than thirty years, I can speak as one with some authority, and I can unhesitatingly say that all true and permanent progress will be, and must be, based on scientific work and investigation, and I will go further and say that of all the sciences taking part in this work—and they are many—chemistry is the one that above all others will, and must, take the first place. The problems in agriculture that await solution are practically innumerable and they are varied as to their character and nature, but I venture to say there are few of them that do not call at one stage or another in their working out for the assistance that chemistry only can give. There is a great future for profound, chemical, investigatory work in agriculture; would that those in authority had the knowledge and foresight to realize it.

But my point to-night is that whatever chemists and chemistry can do towards increasing the wealth and promoting the welfare and prosperity of the peoples of this Dominion, in the advancement of agriculture, in the development of manufactures, in the working of our mines, our smelters and refineries, our wood and pulp industries,

can be done more effectively, more economically if the chemists of this country have organization. Whether this work be of the nature of the working out and control of processes, general analysis or profound research, we feel confident that a closer organization than now exists among Canadian chemists will conduce to greater progress and greater efficiency.

But before pursuing this subject further and indicating, as I hope to do in outline, the several advantages that may accrue from such an organization, I wish from common gratitude to pay a tribute of thanks to that splendid British organization to which we in Canada owe so much—The Society of Chemical Industry—and to place on record an expression of our high appreciation of all that it has done for chemists in Canada. It is the Society to which many of us here to-night are proud to belong, the society under whose auspices we meet this evening, nay more, we meet as a branch of its Canadian section and are, therefore, part and parcel of the parent organization. It is this society that enabled Canadian chemists to take the first steps towards organization. This is something to be thankful for, something that we ought never to forget. As you are aware, as long ago as 1902, branches of this Society were formed in Canada. Toronto, Montreal and Vancouver have had branches in successful operation for a number of years. In this, the Society has done a good work. It has helped us with prestige, it has helped us financially and it has offered us an avenue for the publication of our work in the columns of its journal. For all this, we would like to convey to our parent society our grateful acknowledgements.

It may be found after a thorough consideration of the whole matter that this relationship, which in a measure gives us a fellowship with the chemists of the Empire, is too valuable a one to cast off. A consensus of opinion and an inventory of our strength and resources, may show that it is impossible for Canadian chemists to stand alone, and if such be the case, we must loyally and enthusiastically continue our work under the present auspices. No one will more heartily support the present arrangement than myself. It has worked satisfactorily in the past and it is quite possible it may meet our needs for the immediate future.

We have, however, to recognize that there has been a growing feeling of late among the chemists of this country that our affiliation with the Society of Chemical Industry does not offer the very best form of organization for Canadian chemists. As evidence of this, I need only mention the recent formation of an independent association of chemists in Winnipeg, Manitoba—a mistake, in my opinion, but not one that is irremediable. However, at this juncture, I wish to very frankly state that I, to a very large degree, share in the opinion that the time has come to strike out for ourselves and form a Dominion-wide society — a Canadian Institute of Chemistry or a Canadian Chemical Society.

I wish, therefore, to place before you tonight for your consideration and discussion the desirability of one organization of chemists for Canada, with a constitution that would enable it to enroll all bona fide chemists in good repute from the Atlantic to the Pacific. What, then, are the objects which we should have in mind in considering this matter, what are the advantages to be gained by the establishment of a national society? These we will now briefly discuss.

First, there is the raising of the status of the Canadian chemists. This, to my mind, is the principal object we should have in our consideration of this subject. It may well be asked if the Canadian chemist, unless he hold a professorial position at a university, has any recognized professional status in this country. It is very doubtful if he has. Most certainly he does not rank with members of the medical and legal and engineering professions. Let me cite one or two instances in support of this statement. A few years ago, a well-known Canadian chemist, holding an important and responsible position in the country, was subpoenaed to give evidence in a case involving several millions of dollars. He prepared himself for the case, studying its various phases and aspects. He was on the stand for two days and his evidence covered many folios. He sent in an account for $200, which he thought a modest sum under the circumstances. The Court ruled that he was entitled to $4 a day and expenses, and that is all he received. That is an illustration of how the Courts of the land view or estimate the professional status of the Canadian chemist. Another instance, the Civil Service Commission is to-day advertising for a chemist who must be an honor graduate in chemistry of a recognized university, with at least one year's experience in analytical work of a certain specialized character, and the salary offered is $1,300 per annum. This is how our Government views the importance of the science of chemistry and the status of the profession. Do you think the Government would have advertised for a medical man or a lawyer or a qualified engineer at such a salary?. I think not.

Well, if these instances are fair and representative—and I could cite many more, bearing on the same point—as, for instance, when a minister of the Crown wanted me, not so many years ago, to accept as chief assistant in our laboratories at the Experimental Farm a clerk in a drug store, not discerning the difference between the nature of the work of a drug store and that of a chemical research laboratory—what, I ask, can we do to raise the status of the chemist? We certainly ought to do something. I do not see that there is any possibility of any advance in that direction until we have a national society, with high standards of membership—a society that, by its very constitution, its standing in the professional world, could in time create and exert an influence throughout the length and breadth of the land.

Then, again, I think a national society of chemists of the nature I have indicated would be the very best protection the profession could have against the half-educated, poorly-equipped and often not over-scrupulous chemist that is found practising, often for a reduced fee, in every country. We have them in Canada, and this country, as well as its responsible chemists, needs protection against them. Much money has been thrown away, as I very well know, on propositions floated on the strength of inaccurate and misleading analyis. Several instances of this nature, in connection with so-called potash discoveries in Western Canada, have come officially before me during the past two or three years.

Secondly, a national society would create a strength and an influence that could be used as occasion dictated in matters of moment to the country and its best interest. Of course, I refer only to matters of wide importance and which by their nature fall within the province of chemists to advise or offer an opinion upon. There ought to be, and I am sure there are, from time to time questions upon which a corporate body of chemists could, by public pro-

nouncement and by memorials, well advise our people and their legislators. As, for instance, in establishing standards of quality for all classes of manufactured and industrial products, foods, fuels, etc., and in making of regulations which should safeguard the health of the workmen and the public generally. The industries look well after their own interests in such matters—that is true the world over—the public needs education and protection, and we as chemists have a responsibility in all this, which we ought not to neglect or ignore. There is in this a national work to be done, and it is only a national society that can do it.

Thirdly, a national society of high standing and with high ideals would act as a stimulus to more thorough, profound and careful work by our Canadian chemists. It would furnish an incentive for the best work. Without a due realization of the high character of our work, we become but drudges. Once chemistry is on a plane with the so-called learned professions, the best of our men, the ablest, at our universities, would enter it; for chemistry not only ranks with the most interesting and fascinating of all sciences, but, as you will all admit, it offers problems and a field of research that call for the brightest intellects, the finest scholars the country can produce. Canada, as she grows, will need, and must have, more and more chemists, and chemists of the very highest ability. How else, I ask, is she to take a place in the front rank of civilized peoples?

Fourth—A national society would make possible a journal for the publication in Canada of Canadian work in pure and applied chemistry. This is something that we ought to have for our own use and information and in order to take our rightful place among the progressive nations of the world.

It is true we have a Canadian Chemical Journal (published in Toronto). We are very glad to have it; it is proving an interesting and useful publication from several points of view. But its sphere is necessarily limited, and it is not within its province to print papers on theoretical, abstract subjects and matters of pure research, of interest only to those who are engaged in, or interested in, the science of chemistry, apart from its application. The only avenue for the issue of such papers at present in Canada, is in the transactions of the Royal Society of Canada, and this avenue does not seem to have appealed to very many of our chemists, possibly because of the restricted distribution of the transactions.

It is not necessary, I am sure, to enlarge upon the advantage of such a journal as I have spoken of. There ought to be a sufficiency of material to maintain a quarterly of high quality and if at first there were a difficulty in getting papers of the right stamp, surely the very existence of such a journal would be an incentive, especially to our younger chemists, to enter upon investigatory work, for publication in its columns. It would be a matter of pride to us and all Canadians to have a journal of purely Canadian work. Presumably, at first, it would be a very modest affair.

As to the constitution of such a national society of Canadian chemists, I would tonight merely outline what might be desirable or possible. It is well that we should discuss this evening this phase of the subject, but, after learning the views of our members, those of the chemists throughout the Dominion must be ascertained, and the details should then be left in the hands of a strong and thoroughly representative committee.

Briefly, my idea would be a society that would include fellows, associates and, if found practicable, general members. It might be modelled after the Institute of Chemistry of Great Britain and Ireland and the recently formed Australian Chemical Institute, though I am of the opinion that a Canadian society should be built upon a broader basis than either. It must be something more than a mere registration society, if it is to have a wide appeal and receive the necessary support for its maintenance.

The election of fellows and associates should be by examination or based upon chemical training, qualifications and experience of the candidate. Each election should be approved by the central council of the society. A high standard should be insisted upon, so that the status of fellowship and associateship should be tantamount to, and generally and professionally recognized as equivalent to, chemical degrees.

I have said that, according to my views, the society should not be restricted in its function to registration, as, for instance, is the Institute of Chemistry of Great Britain. It should be a society that would bring its membership together for the reading of papers, for lectures and discussions on chemical matters generally, in as many branches as may be deemed necessary or desirable at centres throughout the Dominion. I am aware of the difficulties that would be met in establishing and maintaining a society which included the professional and non-professional member. Whether these difficulties are insuperable, I cannot say. If it were possible, I should like to see those interested in chemistry, but not professional chemists, find a place in the society.

The society would be governed by a council elected annually by the fellows and associates, and meeting, say, three or four times in the year for business at headquarters or at one or other of the large cities, as might be determined on. The society would necessarily have its charter fellows and associates elected, say, during the first year of its existence and drawn from the ranks of Canadian university professoriate, from the ranks of Government practising and industrial chemists, etc. The committee on constitution could make out a list of good men for consideration of the council. The fees, of course, would be graded, and each branch would have its own local officers. The society would undoubtedly require some financial assistance on the part of the Government, if it were to support a journal. If it could be shown that the society was really a good thing for Canada, such assistance should not be very difficult to obtain, and I think it could be demonstrated that a national society of chemists would prove a very valuable institution, not merely for the profession, but for the country at large.

In all this, I have not tried to exhaust the field. I have perhaps touched upon the more important and salient features in the matter of the establishment of a purely national society of Canadian chemists. It is not my desire in the least to impose my views upon you. In what I have said, I have endeavored simply to place before you the main points, as I see them, that we must consider, and I trust that my remarks, necessarily of a fragmentary nature, may be of assistance in leading our discussion to-night into definite lines. Let our discussions have breadth. Let us, if possible, reach a decision on the main subject—the desirability of a Canadian Society of Chemists; we can well leave details for future consideration.

An address given before the Ottawa Branch, Society of Chemical Industry, December 5th, 1918.

OBITUARY.

Major James Burns.

We regret to learn of the death of Major James Burns, who graduated from the University of Toronto in 1914 in chemistry and mineralogy. Major Burns was killed in action in France on September 28th, at the age of 25, while establishing his battery in a forward position. He left Canada as lieutenant in the 41st Battery in February, 1916, going to France in June of the same year. He was promoted to the rank of captain and later major on the field. At the time of his death, he was in charge of the 32nd Battery, C.F.A. During his course at the University, he was registered at Victoria College. His rapid promotion in France was earned directly through his superior qualities for leadership, which were manifestly evident throughout his college career.

H. P. Corliss.

On November 16th, at Ray, Arizona, at the early age of 32, the death occurred of Dr. Harry P. Corliss.

Dr. Corliss was well known in Toronto, having taken post-graduate work in physical chemistry at the University, making a specialty of the chemistry of colloids. He was a graduate of New Hampshire State College, receiving his B.Sc. in 1910. After leaving Toronto in 1912, he accepted a position as Industrial Fellow at the Mellon Institute, Pittsburgh, receiving the degree of Doctor of Philosophy at the University of Pittsburgh in 1913.

While with the Mellon Institute, he carried to successful completion much research work connected with the development of flotation processes. The application of much of this research is yet in its infancy, while results already obtained would indicate that the work done during this period was of first-rank importance. For the last two years, Dr. Corliss was chief chemist and metallurgical engineer of the Metals Recovery Company and had already met with success on many large-scale applications of flotation processes. He made close personal friends everywhere, and through the recent epidemic of influenza, chemical engineering has lost one of its most promising younger men.

LIEUT.-COL. REUBEN W. LEONARD.

Lieut.-Colonel Reuben W. Leonard, who has recently been elected president of the Engineering Institute of Canada, was born in 1860 at Brantford. He received his education at Brantford Collegiate Institute and the Royal Military College, Kingston, where he graduated in 1883, winning the silver medal. After two years' experience on the engineering staff on the C.P.R., in survey and construction work in the Lake Superior district, he served as Staff Officer of Transport in the North-West Rebellion in 1885. After being released from his military duties, he again took up engineering and construction work with the C.P.R., which profession he followed for several years in Manitoba, Quebec, Ontario, and British Columbia. In 1887, he transferred his energies to the East, acting as chief engineer in the construction of several railways in Nova Scotia. In 1892-3, he was in charge of the construction of Hydro-Electric Power plants at Niagara Falls, Ont., and from 1904-1906 took charge of the construction work for the Hamilton Cataract Power Company, St. Catharines, and the Kaministiquia Power Company, near Fort William. In 1906, he promoted the Coniagas Mines, Limited, of which company, as well as of the Coniagas Reduction Company, he is president.

In addition to his professional activities, Lieut.-Colonel Leonard has many other interests. He is a member of the Board of Governors of Toronto University, Kingston School of Mining, Wycliffe College, Toronto, and Bishop Ridley College, St. Catharines. He is past vice-president of the Canadian Mining Institute and Canadian Society of Civil Engineers, a past member of Council of the Institute of

LIEUT.-COL. REUBEN W. LEONARD.

Mining and Metallurgy, London, England, and a member of the American Institute of Mining Engineers, as well as a past president of the Royal Military College.

The Engineering Institute of Canada is to be congratulated on having secured as president a man of such wide experience and insight in matters which particularly concern the engineering profession as a whole.

DEVELOPMENTS IN ELECTRICAL PRECIPITATION.

Dr. J. D. Davidson, of the University of British Columbia, has for the past four years, and under the auspices of the Advisory Research Council, been working upon the problem of the removal of tar and carbon in the gases coming from by-product coke ovens. The process used is that known as "electrical precipitation," and consists in electrifying particles of dust, smoke or fog statically, and collecting them by attracting them to a surface that is charged with an opposite potential.

Dr. Davidson has demonstrated that this process does away with the loss and trouble caused by the lodging in the gas mains of deposits of tar fog and carbon dust carried in suspension by the hot gases. Although no new theoretical development has been brought out in this connection by Dr. Davidson, yet the practical application of his work is of the first importance.

CHARACTERISTICS AND UTILIZATION OF LIGNITE.*

S. M. Darling.

Wastes in Present Methods of Burning Coal.

THE practice of burning high volatile coals on ordinary furnace grates is wasteful.

Our leading engineers and chemists have for many years decried the waste of burning raw bituminous coal. They have time and again shown that it is far more economical to break the coal up, by means of carbonization, into its constituent elements of solid carbon, gas, ammonia, oils and tars, thus releasing these several valuable products for use in their respective fields.

The fixed carbon is easy to burn because it stays on the grate. The tars and the more complex gases distilled and rising from the fuel bed are quickly decomposed into soot and simple gases, and the soot in large measure passes out of the stack as black smoke, adding the element of nuisance to that of waste. Heat in the form of coal gas brings eight to sixteen times the price of an equivalent amount of heat in the form of coal. Benzol, toluol, and other oils are obtained as a result of this process of carbonization, and the value of heat in this form of motor fuel is twenty to thirty times as great as that of heat in the form of coal. (U.S. Bureau of Mines Bulletin 135.)

Further, the cheapest method of obtaining nitrogen products for explosives or fertilizers is to procure them from the ammoniacal liquor and gas resulting from the carbonization of coal or its gasification in by-product gas producers.

It is undeniable that in the future the principal use of high volatile coals will be in the by-product gas plants because of the higher commercial value of the products of carbonization. It is even suggested that "the time may come when our views of the relative values of the different coals will change and we shall consider anthracite as of minor importance as compared with the high volatile bituminous coals." (U.S. Bureau of Mines Bulletin 135.)

In Bulletin 102, part 4, of the Smithsonian Institution there appears the following suggestion:

"It is not beyond the bounds of reason to foresee a condition whereby a householder, in the place of his ton of anthracite which he now welcomes for $11.00, will receive a ton of smokeless coal without slate, a month's supply of cooking gas, 40 miles of motor fuel, enough fertilizer to start a small garden, and tar sufficient to allay the dust in front of his house—all for far less money than he now pays for inferior coal."

This picture is not a fanciful one; our high volatile coals and lignites contain precisely these possibilities within themselves.

Because of the inherent shortcomings as fuel in the raw lignite itself, one can safely say that it will never be used to any great extent in its raw state. The one fact of its containing 30 per cent. of water would of itself prevent use elsewhere than in the immediate vicinity of the mine. This treatment, or carbonization, of the lignite, therefore, which is absolutely essential to its more general use, is strictly in accordance with modern scientific research. We are simply, from necessity, starting to do with lignite now what will eventually be done with all of our high volatile coals.

*S. M. Darling, of the Bureau of Mines, Washington, has prepared a report on the above subject having in mind the situation at present existing in the United States. The similarity between the problems presented to American engineers and at present facing the Lignite Utilization Board of Canada is sufficient to warrant a review of the American report at the present time. The common situation is outlined below.

Efficient Utilization of Lignite.

Some progress has been made in the way of better utilization of lignite. Instructive experiments have been made by the United States Bureau of Mines, the State of North Dakota, and the Province of Saskatchewan, Canada, which bring the matter measurably nearer to a satisfactory solution.

Instead of trying to burn the raw lignite in the primitive and wasteful ways now employed, it should be modified to produce several products, each peculiarly adapted to a particular commercial need, namely:

1. *Dried lignite*, for use on automatic stokers and in fuel-gas producers. Because of its more or less soft and comminuted condition the dried lignite can not be handled advantageously by hand, but it can be used very satisfactorily by mechanical means.

2. *Powdered fuel*, from the dried, pulverized lignite, for use in cement kilns, railroad locomotives, and other large furnaces. Because of its high volatile content this pulverized lignite makes an exceptionally good powdered fuel.

3. *Dried lignite briquets*, for large hand-fired industrial furnaces and heating plants. Where it is necessary to handle the dried lignite with a fireman's shovel it should be briquetted. Tests of these dried lignite briquets in commercial boiler furnaces have proved them to be equal to good Middle West bituminous coal.

4. *Carbonized lignite*, for use in suction power-gas producers. Tests of this product in carload lots have proved it to be an exceptional and unexcelled fuel for this purpose. Its chemical composition, as shown by analysis, is about the same as that of Pennsylvania anthracite. In carbonizing the lignite, the objectionable tar found in all coals containing a substantial quantity of volatile matter is removed, and the gas goes to the cylinder of the gas engine clean and tar free. For the production of power in this way carbonized lignite is fully equal to anthracite coal, charcoal, or bituminous coke, the standard fuels for such purpose.

This carbonized lignite can also be burned satisfactorily on the automatic stokers and grates used to consume the smaller sizes of anthracite.

5. *Carbonized lignite briquets*, for domestic service in house heating stoves and furnaces, fireplaces, and cooking ranges. This fuel, ton for ton, compares favorably with anthracite coal, and is an ideal domestic fuel in such rigorous climates as those of North Dakota and Alaska. In climates where the thermometer not infrequently goes to 40 below zero this demand is immediate and very large.

6. *Sulphate of ammonia and producer gas*: The raw lignite, just as it is mined, when used in by-product gas producers of the Mond type, makes sulphate of ammonia, producer gas, and some tars of undetermined value; there is no solid residue except ash. Lignite carries on the average, about 1.40 per cent. of nitrogen. If this nitrogen were wholly recovered as sulphate of ammonia the yield would be about 147 lbs. per ton of lignite. This theoretical yield, of course, could not be obtained in commercial practice; the actual yield of sulphate of ammonia per ton of lignite gasified would be 70 to 80 pounds. Ammonium sulphate is now selling for 6 to 7 cents per pound. Before the war it sold for 3 to 3½ cents per pound; but, as the price of this commodity is determined in world markets, it will probably drop back to near the pre-war price when industrial conditions become normal again. The gas yield per ton of lignite would be 60,000 to 70,000 cubic feet of about 140 B.t.u. per cubic foot. This gas could be used as a furnace fuel or in a gas engine to produce power. If the latter, it

would yield 700 to 800 horse-power hours per ton of lignite gasified.

The fact that the lignite does not coke in the sense that bituminous coal cokes, but rather crumbles, on being carbonized, makes possible a continuous and comparatively inexpensive distilling process, thus obviating the laborious and expensive charging and drawing of retorts as practiced in coal gas plants. It also parts with its volatile content more readily than does bituminous coal. The entire process is mechanical. The fuel need not be handled by manual labor from the time the lignite is loaded into the mine car until the briquets are en route to the consumer. The costly element of labor is reduced practically to that required for directing mechanical operations.

By-products from Lignite.

In carboniing the lignite, valuable by-products in the form of gas, ammonia, and oils and tar are obtained.

The Gas.

The gas yield is upward of 10,000 cubic feet per ton of lignite. The gas has a heating value of 400 to 450 British thermal units per cubic foot.

A little more than one-half of the gas is necessary to carry on the carbonizing process; the balance can be used as a city gas for cooking, or for lighting if burned in a mantle, for furnace fuel, or for generating power by means of a gas engine. Or, if desired, the entire 10,000 cubic feet can be devoted to these purposes and the carbonizing carried on with lignite producer gas from a fuel gas producer.

If the gas should be used as a town gas, and a higher thermal value than 400 B.t.u. per cubic foot were required, the whole 10,000 cubic feet can be enriched to the desired point. The Director of the Oil Division of the Fuel Administration has proposed that the heating values of carbureted water gas sold for domestic use shall not be over 528 B.t.u. per cubic foot. Or, in a carbonizing oven of the Saskatchewan type, the poorer portion of the gas could be collected separately and only the richer portion, about 7,000 cubic feet, sent into the city mains, without enriching. The inferior gas would not be wasted, but could be used as bench fuel, supplemented by producer gas. If it were desirable to do the carbonizing exclusively with the oven gas, the richer portion available for distribution in city mains would be reduced to between 3,000 and 4,000 cubic feet per ton of lignite.

The fact that the sulphur content of lignite is small is a good feature. There is an almost entire absence of the corrosive acid resulting from the combination of sulphur with water when the lignite is burned. Should the lignite gas be used as a "town gas" for heating, cooking and illuminating purposes, there will be almost no sulphuretted hydrogen to be removed by means of hydrated oxide of iron purifiers.

Consider the matter of power: Of the yield of 10,000 cubic feet per ton of lignite carbonized, 6,000 cubic feet are required to carry on the process, leaving a surplus, costing nothing, of 4,000 cubic feet, of 400 British thermal units per cubic foot, or a total of 1,600,000 British thermal units. A good gas engine uses about 10,000 B.t.u. per horse-power hour. This gives 160 horse-power hours from the surplus gas from each ton of lignite carbonized. This power is comparable in cost with that derived from natural gas. It is fully as cheap as most hydro-electric power.

This cheap power, of course, is limited by the quantity of lignite carbonized. But the first need of the people of northern climates is domestic fuel, hence the demand for these carbonized lignite briquets is very large. As the population and the demand for power increase, the demand for this carbonized fuel will increase apace. If the demand for power in any lignite field should outrun this supply of surplus gas the amount of power can be readily and cheaply augmented by the use of carbonized lignite in power gas producers.

The by-products should at least pay the cost of carbonizing and briquetting, thus affording a first-rank fuel in place of one of lowest rank, at no additional cost.

It is not necessary to dwell upon the benefits that would ensue to these lignite sections by thus placing them in possession of a fuel equal to anthracite and a supply of cheap electrical power.

And these remarks apply to *one-third* of the coal resources of the United States.

The Ammonia.

The ammonia is contained in the gas and gas water. It may be recovered as ammonium sulphate, a valuable fertilizer, as anhydrous ammonia, for refrigeration and other commercial purposes, or it may be treated as the source of other nitrogen products, some of which are of vital importance in the manufacture of explosives. As stated above, this and the Mond process are the cheapest sources of these products, but the amount which can be so recovered is limited to the tonnage of coal carbonized or gasified. The manufacturing practices in this connection have long been standardized.

The Oils and Tars.

Just what is the most profitable disposition to make of the oil and tar products in this country remains to be determined. This is an industry by itself.

The simple distillation products of this oil can be put to many uses—fuel oil for furnaces and internal combustion engines, creosoting oils for the preservation of timber, waterproofing and preserving oils for leather and cotton and other fabrics, tar paper, roofing pitch, etc.

The pitch makes an excellent binder for the briquets, and will go far toward reducing the cost of this item, if more valuable uses are not found for it. The anthracite and creosote oils will, without doubt, find a ready market as wood and leather preservatives.

From the several fractions, upon exhaustive distillation and treatment, are derived hundreds of synthetic products in the way of paraffin, acids, antiseptics, photographic chemicals, aniline dyes, perfumes, drugs, preservatives, etc.

From the light oils come benzol, toluol, aniline dyes, photo-chemicals, certain drugs, and many other chemical products. From the carbolic and creosote fractions are derived carbolic acid, creosote, picric acid, photo-dyes and chemicals, coloring materials, and numbers of perfumes. The anthracene oils give, among other things, alizarin, a valuable acid used in the production of dyes, and carbolineum, used as a wood preservative. This latter product is analogous and equal in value to the carbolineum derived from European lignite, which before the war was imported in large quantities and retailed at 65 cents per gallon in barrel lots.

At first, of course, the simple distillation products will be procured and marketed as such. But as opportunity affords, each of these primary by-products will be taken up and synthetic chemical products manufactured. The exact course of this development is a matter to be determined in conjunction with a careful study of the market.

INDUSTRIAL NEWS.

A new pulp company has started operations at Hawkesbury, Ont., under the name of Manson's, Limited. They are at present pumping sulphite screenings from the bed of the river, which have been deposited there from previous pulp-milling operations. After treatment, the product is sold as a lower grade than ordinary sulphite pulp.

The contract for the steel work in the construction of a $10,000 power house for the Manitoba Steel Foundry Co. has been awarded The Dominion Bridge Company, Canada Building, Winnipeg. The building is to be erected at Mapleton, Man.

A partnership has been registered at Vancouver by H. J. Gardiner, under the name of Columbia Chemical Company.

The capital stock of Scottish Canadian Magnesite Company, Limited, Hull, Que., has been increased from $600,000 to $1,000,000.

The plant of the Maple Leaf Milling Company at Welland was badly damaged by fire. The loss to the building, machinery and stock of the company is estimated at between $50,000 and $100,000, which is, however, covered by insurance.

The Canadian War Trade Board announces that the regulations which have been prohibiting the exportation of explosives containing more than 42 per cent. nitroglycerine, have been removed. Exporters can, therefore, resume their normal export business. The War Trade Board have also announced the cancellation of the resolution passed at their meeting held on October 9th, prohibiting the use of structural steel, steel shapes, plates, bars or any other form of steel, the value of which exceeds $2,000, in the erection of any buildings or structure of any kind. Therefore, it is no longer necessary for permits to be obtained from the War Trade Board for the use of steel in the erection of buildings.

The Commissioner of Immigration and Colonization reports that the output of aeroplane spruce in British Columbia during October totalled 5,200,000 feet—this amount being about equal to the output of all the American camps on the Pacific Coast.

A new company is to be formed to take over the property of the Aetna Explosives Company, Limited, which has been in the hands of receivers. There will be approximately $8,000,000 in liquid assets to continue the business, while about $3,000,000 of the war earnings of the company will be applied to outstanding bonds and payments of back dividends on preferred stocks.

The Dominion Government has announced the creation of a Canadian Trade Commission, with headquarters at Ottawa, which will co-operate with the Canadian Mission in London, with a view to securing for Canadian producers a share of the business arising out of the reconstruction work in France and Belgium. The Commission is to be composed of three members—Sir Charles Gordon, of Montreal, who will be chairman; Mr. Chas. B. McNaught, of Toronto, and Mr. H. B. Thomson, of Victoria, B.C. Authority will be given the Commission to select and appoint advisory or associate members, as they may deem advisable.

A meeting of the Canadian Woollen Manufacturers' Association was held in Toronto recently to consider the question of securing a satisfactory share of European reconstruction orders, and the part to be played by the Commission in securing and distributing the business so secured.

The Flint Varnish and Color Works, Toronto, are establishing a research laboratory in connection with their plant. Mr. H. F. Blake, of Flint, Michigan, is organizing the work as chief chemist.

The Steel Company of Canada, Hamilton, expects to increase its present staff by ten per cent. as they have already in sight sufficient orders to justify this step.

The strike in the J. R. Booth Paper Mills at Ottawa is now over, and the mills re-opened, after having been closed down for three weeks. The union accepted the compromise offered by Mr. Booth.

France has formed a combine, with a capital of forty million francs, for the manufacture of all chemicals. It has already a factory capable of producing 2,000 tons of indigo annually, and is independent of Germany for chemical and dye products.

The Canada Metal Company, of Toronto, will erect a $50,000 plant in Halifax for the manufacture of sheet lead, lead pipe and brass forgings.

At a recent meeting of the directors of the North American Pulp and Paper Company, Montreal, Mr. J. E. Houseman was appointed vice-president of the company, and general manager of its chief subsidiaries—The Chicoutimi Pulp Co., the St. Lawrence Pulp and Lumber Co., and the Roberval and Saguenay Railway. Mr. Houseman will make his headquarters at Chicoutimi.

The Canadian Copper Corporation is reported to be making good progress on the completion of its 2,000-ton mill on its Copper Mountain property. The company will start production with at least 12,000,000 tons of official ore reserves.

The Alamo Concentrator, at Three Forks, Slocan, B.C., is being dismantled and will be replaced by a new mill, 150 tons capacity, to cost $167,000.

The principal plumbing firms in Victoria, B.C., have combined, under the name of Vancouver Island Marine Plumbing and Heating Company, to more efficiently handle the plumbing work of shipbuilding in Victoria.

The Columbia Steel Works, Limited (formerly the Port Moody Steel Works) are turning out large quantities of pig iron from their electric furnace, and expect shortly to turn out steel rods and bars.

On December 7th, an explosion occurred in one of the outlying buildings of Canadian Electro Products Company, Shawinigan Falls, Que., were acetaldehyde and acetic acid were being manufactured. Some three hundred persons were working in the vicinity, on the night shift, at the time. Immediately after the explosion, fire broke out in the ruins. Four bodies were recovered, while at least seven others are missing.

The Canadian Cartridge Company, Hamilton, announce that the addition to their factory, which represents an expenditure of $100,000, is nearing completion. The machinery to be installed is for the manufacture of steel barrels for Canada, United States and other countries, and about three hundred men will be employed when operations start at the New Year.

The Brompton Pulp and Paper Company have taken over the Odell Manufacturing Company, of Groveton, N.H. The Odell Company's products include sulphite pulp, bond and fibre paper, and in the past they had been large customers of the Brompton Company. As a result of the merger, 200 tons per day will be added to the output of the Canadian company.

L'Air Liquide Society have secured a site on Dundas St., London, on which they propose to erect a factory for the production of oxygen and acetylene. Mr. E. Jordan is the general manager of the Society for Canada.

On December 2nd, a fire at one of the terminals of the Shawinigan Water and Power Company, Montreal, caused damage to machinery and stock to the amount of $20,000.

The Chicago office of the Electro Bleaching Gas Company, of New York, temporarily closed on account of the war, is to re-open at its former address, 11 La Salle St., and is to again be in charge of Mr. G. R. Ellis.

The Consolidated Mining and Smelting Co., at Trail, B.C., have announced that low-grade ores can be smelted, under the new process, at a profit at $1 per ton. As millions of tons of ore and many good, low-grade properties have remained idle because of the hitherto unsolved problem of smelting, the discovery will mean much to hundreds of companies.

The Atlantic Sugar Company's business is exceptionally good at the present time, and it is expected that the company will soon be in a position to pay to the shareholders some four and a half years' back dividends.

At the meeting of directors of the Asbestos Corporation, to be held on December 20th, in New York, it is expected that a 4 per cent. dividend on the common shares of the company will be declared.

The annual report of the Sherwin-Williams Company of Canada shows results of the business in sales and net profits as above all previous years.

The Tudhope Electric Metals Company, Limited, have under construction an electric smelting works at Vancouver. They are installing the most improved type of plant, using high-voltage electricity. Several members of the technical staff have arrived from Eastern Canada, and the plant is expected to be in full operation shortly.

The Steel Company of Canada, Hamilton, intend installing a benzol building in connection with their new coke ovens. The building will be at a distance from the other by-product buildings, and will be entirely enclosed by a 12-foot brick wall.

A plant for the manufacture of peat is being installed at Tweed, by Messrs. Capelle & Trudeau, the bog from which the fuel will be obtained being about six miles from the village. Mr. Capelle, who is a returned soldier, has had experience in making and marketing peat in Belgium, his native land. The local market price for the finished product is to be $9 per ton.

NATURAL GAS COMMISSION.

The Natural Gas Commission has been recently appointed to take over the duties of the Ontario Railway and Municipal Board, in dealing with gas matters for the Province of Ontario. Eight members have been appointed, Mr. E. S. Estline being chairman of the Commission. The personnel is as follows: For rural interests, Judge Stanworth, Chatham, and Warden Mahoney, Wentworth; for urban interests, Mayor West, Woodstock, and City Engineer Gray, Hamilton; for gas distributors, P. S. Coate, Chatham, and C. E. Steele, Port Colborne; for gas producers, H. R. Davis, of Dominion Natural Gas Company, and P. A. Little, Buffalo.

RECLAIMING AMMUNITION DUMPS.

Much speculation is rife as to what is to become of the tremendous amount of ammunition left lying on the western front since hostilities have ceased. Millions of pieces, five feet in length and weighing three-quarters of a ton each, lie out in the open, where they will corrode, and the explosives will be weakened. This, of course, with copper at $500 a ton, and other metals in proportion, will not be allowed. Nitrates which have gone into the making of explosives may be extracted and turned into fertilizer for the devastated fields of France, the melting down of the metals of which the shells and ammunition are composed will recover from a fifth to a quarter of their cost. Most of the explosives are soluble, or may be melted and poured out of the shell cases. Detonators may be dumped into the sea; fuses may be picked apart and cordite cut with bronze scissors without danger of explosion.

CHEMICAL SOCIETY NEWS

Society of Chemical Industry, Ottawa Branch.

The first meeting for the season of the Ottawa Branch of the Society of Chemical Industry was held on the evening of December 5th, when about forty members assembled in the grill room of the Russell Hotel. After dinner, Dr. Frank T. Shutt, the chairman of the Ottawa Society, read a paper on the subject of "Organization for Canadian Chemists," which is treated elsewhere in this number, and when he concluded, the meeting was thrown open for the full and free expression of the opinions of the members on the subject. As Dr. Shutt had indicated that he desired nothing more than that the members should feel very free to express their views, the discussion soon became quite animated, and at eleven o'clock was still in full swing. The trend of discussion had by this time become quite definite, however, and it was in order that the sentiment of the meeting should be recorded in the form of a resolution. There was considerable debate as to the length the members should go in this matter; some favoring a very definite and advanced line of thought. After a little further debate, the thought of the meeting was crystalized in the following resolution:—

> "That it is the opinion of this meeting that the organization of Canadian chemists is best undertaken by a new and separate organization, rather than by endeavoring to carry out such organization under the auspices of any existing society."

The meeting was in every way a success. Those present represented quite a large number of interests, and the discussion was very generally taken part in by those present. Several were present from other places, among these being Mr. T. H. Wardlworth and Mr. H. J. Roast, of Montreal. Mr. Roast outlined at some length the work that has so far been done by the Committee appointed at the Convention of Canadian chemists last May for the purpose of considering the subject of organization among chemists and of bringing in a report to the next convention. Although nothing has been made public as yet, the activities of this committee are taking definite form, and it is hoped that the proposed scheme will be submitted for criticism to the chemists throughout the country at an early date.

The next meeting of the Ottawa Branch will take the form of an exhibition of motion pictures, showing the development at Shawinigan Falls and the "Fixation of Atmospheric Nitrogen," as carried on by the American Cyanamid Co. at Niagara Falls. This meeting will be held on the 9th of this month.

Society of Chemical Industry, Toronto Branch.

Two very interesting addresses were given on December 19th before this Branch.

Prof. E. G. R. Ardagh occupied the chair, and welcomed some ten new associate members. Dean Goodwin, of Kingston, Chairman of the Society for Canada, was present. Mr. S. Adinoff, of the Van der Linde Rubber Co., gave a detailed account of the manufacture of picric acid on a large scale. A synopsis of his address follows:—

Address of Mr. Adinoff.

Picric acid is one of the oldest synthetic organic compounds known. Picric acid is a trinitro phenol and is made from phenol and nitric acid. The reaction, however, is not a direct one. An intermediate product of phenol and sulphuric acid, phenol sulphonic acid is produced first. The sulphonic acid of phenol is then nitrated and the SO_3H radicals replaced by NO_2 radicals and nitrated further to picric acid (only the disulphonic acid is produced on sulphonation of phenol).

$$C_6H_5OH + 2H_2SO_4 = C_6H_3OH(SO_3H)_2 + 2H_2O$$

$$C_6H_3OH(SO_3H)_2 + 3HNO_3 = C_6H_2OH(NO_2)_3 + 2H_2SO_4 + H_2O$$

While picric acid has been manufactured for a very long time and found application in the arts, as well as pharmaceutical and medicinal uses, its manufacture until the war broke out was conducted in the United States and Canada on a very small scale, and it is even possible that the manufacture was quite unknown on the American continent, the small need of the product having been supplied by importation from Germany. Only with the beginning of the war, the great need of picric acid, which is one of the most powerful explosives known, stimulated many manufacturers to great efforts on a large scale. The first great difficulty was found in obtaining a supply of raw material. The natural supply of phenol was quite limited, and manufacturers had to make synthetic phenol by methods previously untried in America. As for the manufacturing process, the greatest difficulty encountered at first was the filtering and washing of the picric acid crystals. The sulpho-phenol was mixed with strong sulphuric and nitric acids in glass-lined tanks, with constant agitation, controlling the temperature by means of cold water and steam jackets. After the process was finished, the picric acid had to be separated from the mother liquor and washed. This was done by means of diluting the mixture with large quantities of water in slurry tanks, and then filtering it through filter beds made of porous earthenware bricks. The crystals, however, being finely subdivided, filtration was very difficult. Particles of the filter bed would come off and mix with the picric acid, bringing up the ash content to prohibitive proportions. This difficulty was overcome by improving the process, so that the concentration of the acids and phenol present was fixed in such a way as to allow the product to crystalize out in large crystals on the surface of the mixture. The mother liquor was then syphoned off, the crop of the acid collected from the pots and washed clean from sulphuric acid by means of centrifugal wringers lined with woollen bags. The specifications of the Government called for ash content less than 0.2 per cent. and H_2SO_4 content less than 0.5 per cent.

The yellow fumes of nitrous oxides are a continual danger and nuisance around the plants. On coming in contact with picric acid, the skin turns yellow, and this color cannot be washed off. One can only wear the color off. The result was that all the men walk around with yellow hands and faces and sometimes yellow all over their bodies. These men were known in the district as "canaries."

As to the future of the industry, there can be no two opinions; it is bound to go down, together with many other war industries. As a dye for silk, it is not much in use now. Its pharmaceutical and medicinal applications are very limited. A project was developed to organize the industry, with the object of placing picric acid on the market as an ordinary explosive, but it is highly problematical whether it will ever be able to compete with cheaper explosives, even after the prices of raw materials have come down to a normal basis.

Following Mr. Adinoff, an able address was given by Mr. Victor Van der Linde on the manufacture of lighter-than-air war craft. Mr. Van der Linde has had much experience in practically all the allied countries in connection with the development of this branch of war work. His personal experiences were also exceedingly entertaining.

The Toronto Branch is much indebted to these gentlemen, who, in the absence of Mr. T. H. Wardleworth, gave such interesting papers. The address of Mr. Wardleworth on "Chemistry in Time of War and Peace" will be given later. At the January meeting, Dr. A. B. Macallum will address the Branch on the work that the Dominion Government is doing in connection with industrial research.

Maritime Chemical Association.

On October 14th, at a meeting of this Association, held in Halifax, two papers were given.

Prof. D. V. Hill, of Acadia University, gave a paper on the manufacture of explosives, detailing work carried on in the laboratory. Prof. L. C. Harlow, of the Nova Scotia Agricultural College, read a paper on "Waste Products as Fertilizer," discussing the cases of certain products of local industries. At a luncheon following the session, Colonel W. R. Lang, of Halifax, formerly of the University of Toronto, spoke on the French and German scientific schools. Visits were made to the oil refinery of the Imperial Oil Company, Ltd., Dartmouth, and to the laboratory of the Department of Trade and Commerce, Halifax. H. B. Vickery, of the Imperial Oil Co., Ltd., Dartmouth, is secretary of this organization.

CATALOGUES RECEIVED.

The National Electric Heating Co., Toronto, showing every variety of electric heating appliance.

Beckley Perforating Co., Garwood, N.J.—Illustrating perforated sheet metals of all kinds and for various uses.

"The Austin Method."—The Austin Co., Cleveland, Ohio. Specifications and illustrations of many standard types of manufacturing buildings recently erected.

"Thermit Carbon-Free Metals."—A very instructive little pamphlet, illustrating the Thermit process and its application. Goldschmidt Thermit Co., New York.

"The Question of Radiation."—E. Wade Wilton, Planet Works, Bramley, Leeds, England. An interesting booklet, illustrating uses of asbestic non-conducting compounds.

"Mining Tanks."—Pacific Tank and Pipe Co., San Francisco. One hundred and twenty-seven pages of information, illustrating the construction and use of tanks of all kinds.

"Zelnickers Bulletin."—W. A. Zelnicker Co., St. Louis. Illustrating rails, locomotives, cranes, shovels, hoists, air compressors, motors, generators and various types of railway cars.

Laboratory Testing Apparatus.—Howard & Morse, Brooklyn, N.Y.

Featuring penetrometers, sieves, extractors and ductility machines.

Sowers Manufacturing Co., Buffalo, N.Y.—A series of catalogues are published, illustrating "Dopp" seamless, steam-jacketed kettles, mixers and vacuum pans, soap-making machinery, boilers, caldrons, grey-iron castings.

"Disintegrators."—J. Harrison Carter, Ltd., Dunstable, England. An illustrated catalogue of machinery of interest to chemical and allied industries. Over two hundred different machines are illustrated in 84 pages.

"The Business World."—Messrs. Adolph Hess & Bro., Ltd., Leeds and Hull, England. This firm has published a very interesting account of various cities in the British Empire outside of Europe. They deal in wool, oils, lubricants and fats.

"J. M. Products."—Issued by the H. W. Johns-Manville Co., New York..

Starting with a Canadian raw product—asbestos, mined at Danville, P.Q.—this company has a large number of factories throughout the United States. All the known commercial uses of asbestos are listed and illustrated.

L'Air Liquide Society.—Canadian Head Office, Toronto. Recent catalogue devoted to Oxy-Acetylene Welding and Cutting Apparatus. Oxygen is sold in cylinders containing from 100 to 200 cu. ft. Dissolved acetylene having acetone as the solvent is sold in cylinders having 200 cu. ft. capacity. The acetylene cannot be discharged at a rate per hour greater than one-seventh of total capacity. When this is exceeded, acetone is discharged, reducing the effectiveness. Compressed air, nitrogen, and coal gas are also listed.

Canadian Ingersoll Rand Company, Ltd., Sherbrooke, Que.—In a new bulletin, K-303, issued by this company, the class EL-2, two-stage, straight-line air compressor is described. The bulletin indicates the advantages of the tandem arrangement for certain classes of work where economy of space is to be combined with the advantages of two-stage compression, and goes on to give details of construction, including the leaf valves and other features. The bulletin concludes with a note on the short-belt drive used with this type of compressor.

CANADIAN TRADE IN SIBERIA.

At the request of the Minister of Trade and Commerce, Mr. John Findlay, a British engineer who has been in business in Siberia for some years and who is thoroughly familiar with conditions there, has come to Canada for the purpose of making himself acquainted with Canadian industrial conditions preparatory to acting on the Canadian Economic Commission to Siberia. Mr. Findlay is now calling on Canadian manufacturers of various line of commodities which he thinks will be in immediate demand in Siberia, or for which there is already a market. Among the latter class of manufactured articles which could be supplied from Canada are asbestos goods, iron for ferro-concrete work, enamel ware, shafting and mill gearing, mining and power plant machinery.

PERSONALS.

Lieut. A. Tower Fergusson, a science graduate of 1911 from the University of Toronto, has been awarded the Military Cross.

Mr. S. G. McAnally, formerly in the employ of the Canada Cement Co., is chemist for the Scottish Canadian Magnesite Co., Ltd., at Hull, Que.

Mr. Walter Hill, formerly with Bates & Innes, Ltd., Carleton Place, Ont., has been appointed superintendent of the Amherst Woollen Mills, Amherst, N.S.

Mr. Arthur W. Cooper, of Beaupre, Que., is one of the provisional directors of the Valcartier Lumber and Pulp Company, Limited, recently incorporated.

Mr. W. F. Geddes, B.S.A., until recently with the British Chemical Co. at Trenton Ont., has joined the chemical staff of the Aetna Chemical Company, Drummondville, Quebec.

Mr. A. C. Wheatley, formerly employed in the laboratory at the Nobel Works, has taken a position as chemist with the Parry Sound Iron Co.

Mr. W. S. Cohen has been appointed general manager of the Dominion Reduction Company at Cobalt. Mr. Cohen was at one time general manager of the Crown Reserve and Porcupine Crown Mines.

Mr. Clayton Reynolds, formerly chemist with the British Chemical Co. explosive plant at Trenton, Ont., has accepted a position with the Canada Paint Co. at their dye and color plant at Montreal.

Major Frederic J. Mulqueen, M.C., of Sao Paulo, Brazil, has been awarded the D.S.O. Major Mulqueen graduated in science at the University of Toronto in 1913. He is now O.C. of a Field Company of the Royal Engineers.

Major L. L. Anthes, general manager of the Anthes Foundry, Limited, Toronto, has been appointed to advise with Col. Healey, Deputy Minister of Soldiers' Civil Service Re-establishment as to the replacement of soldiers in industry.

Lieut.-Col. C. H. L. Jones, who has been overseas for the last four years, has returned to Canada and will shortly resume his position as manager of operation of the Spanish River Pulp and Paper Mills, with headquarters at Sault Ste. Marie, Ont.

Mr. M. L. Davies, vice-president of the Standard Chemical, Iron and Lumber Company, has sailed for Europe for the purpose of superintending the re-establishment of their European pre-war business in the refining and distribution of Canadian wood distillation products. The English and French refineries will be re-opened, but the operation of the refinery at Worms, Germany, will be discontinued. Mr. Davies expects to be absent about two months.

Major T. R. Loudon, A.M.E.I.E., who was invalided home from France in January, 1918, has recently been appointed O.C., Royal Canadian Engineers, Military District No. 11, which included British Columbia and Vancouver Island, with charge of all military engineering work. Before going overseas in 1916, Major Loudon was a lecturer in the Faculty of Applied Science, University of Toronto, and spent some considerable time in electric furnace work. He is a member of the firm of James, Loudon & Hertzberg, Ltd., Toronto.

MEETING OF CHEMICAL ENGINEERS.

The Institute of Chemical Engineers announces the tentative programme for its winter meeting, to be held in Chicago, January 15-18. Under the direction of the leading

chemical engineers of the United States, a number of very excellent and timely papers and addresses are promised. United States tariff questions involving chemical industries will be up for discussion, following an address by Dr. Grinnell Jones, of the U.S. Tariff Commission, Washington, D.C. The settlement of these questions has a direct bearing for certain Canadian industries. Dr. L, J. Matos and Dr. L. C. Jones, of the National Aniline Co., New York, will introduce papers on the United States dye industry. Reconstruction in the chemical industries will be given lively consideration, following a paper by Dr. E. Gudeman, of Chicago. The feeling existing in the United States at the present time is shown by a general letter recently sent by the President of the Institute of Chemical Engineers to the chemical manufacturers of the country, from which we quote:

> "There are some who believe that a high protective tariff is all that is necessary to preserve the chemical industries. There are others who believe that only the newer chemical industries should be fostered, but it is the belief of your committee that the chemical industry of the United States must be carefully assisted, not through any one particular means, but through various methods, which your committee briefly outlines.
>
> "It is impossible to forecast the future, but if Germany fosters or otherwise subsidizes its chemical industries by means of specially low freight rates and transportation facilities, or if other countries pursue such a policy, the American chemical industries will be at a great disadvantage as far as export trade is concerned.
>
> "Of course, it is not to be presumed that the chemical industries will ask Governmental assistance in those things which the chemical industries are competent to take care of themselves. This phase should also be presented.
>
> "In 1919, a large amount of shipping will leave these ports filled with the necessities of life, such as food, agricultural implements and metals, and in preference to coming back in ballast, they may take freight at such low rates, and Germany may be willing to sell the materials it has on hand at such ruinous figures in order to obtain real money, that for a time paralysis of our industries may ensue.
>
> "Another condition that always confronts manufacturers is unnecessary and undue competition, and our laws prevent co-operation, excepting in cases of export."

This meeting is of very special importance, following as it does the closing of hostilities.

MEETING OF NATIONAL PAINT, OIL AND VARNISH ASSOCIATION.

This Association held what was called a "Victory" convention at Boston on December 2nd, 3rd and 4th, 1918. E. J. Cornish, president of the National Lead Company, New York, was elected president of the Association for the year. Optimism was the keynote of the many adresses given, and the great paint, oil and varnish business of America pledged itself to success and prosperity in the new industrial era ahead. Among the measures of interest brought up was one for the establishing of a statistical department which would compile authentic figures of production and costs.

NEW CANADIAN LABORATORY SUPPLY HOUSE ORGANIZED.

A Canadian Laboratory Supply Co., Ltd., with headquarters at Toronto, has been organized recently to meet the needs of Canadian research and industrial laboratories. If experience in the laboratory supply business be taken as a probable measure of the service about to be rendered, the new company should be given a very kindly reception. The executive officers are well known to many buyers of laboratory apparatus and chemicals in Canada. Mr. F. G. McKay is president, Mr. J. H. Wilson vice-president and general manager, and H. B. Hall, secretary-treasurer. Mr. McKay has been fourteen years in kindred lines of business, and has been a close student of educational and industrial developments in every province. Mr. Wilson has been brought up with the laboratory supply business, having made a specialty of salesmanship in these lines for the last

JAMES H. WILSON, GENERAL MANAGER CANADIAN LABORATORY, SUPPLY CO., LTD.

sixteen years. For a number of years, he was manager of the Liverpool branch of the well-known English firm of Baird & Tatlock, and he has become personally known to many Canadian buyers during the last few years. Judging from a survey of their stock, a very complete and high-class line of apparatus and chemicals is made available for immediate shipment. In making the laboratory supply business a main issue, many of the disadvantages of handling such goods as side lines are overcome. We wish this new organization every success in the service it has undertaken for Canadian laboratories.

MONTREAL LETTER.

Correspondence of the "Canadian Chemical Journal," by J. C. Ross.

There is a considerable lee way in the market quotations for chemicals at the present time, but there are at least two reasons for this—in the first place, the holiday season always causes buying in most lines to ease off; in the second place, the time since the armistice was declared has been so brief that there has been no time for the market to really adjust itself. Buyers seem to have adopted a waiting attitude by buying only what they need, and, while they pay the price asked, there is lacking the briskness which characterised the war period. However, there is no panicky feeling, either on the part of buyers or sellers, but rather a period of marking time. It is believed that after a few weeks things will shape themselves to a post-war basis and the chemical requirements of the commercial trade will offset to a large extent the war demand.

In certain lines, such as in brass-casting work, prices have not been adversely affected; lead prices are also holding well. Business directly associated with the holiday trade, such as the perfume and fancy drug trade, has been exceptionally good, but commodities not directly connected

with the Christmas trade show a tendency to ease off in price.

W. Boyd Campbell, assistant director of the Forest Products Laboratories, McGill University, has resigned his position, and takes up new work on the first of January. Mr. Campbell, who is one of the best-known and most competent chemists in the country, is going with the Process Engineers, Limited, of which J. A. DeCew is president. Mr. Campbell spent some time at the front, where he did his bit in producing gas that was one better than anything the Huns sent over. He was recalled from the front to do war work at the Forest Products Laboratory and in the chemical industry in general.

The head of the chemical departments of one of the largest firms in Montreal voices a grievance against the heads of corporations, particularly munition makers. He states that in the last few weeks scores of chemists and metallurgists have been let out by munition companies on a week's notice. In many cases, they have not received the treatment accorded the ordinary workman. He points out that these men were a big factor in the making of profits for the munition makers during the four years of war, and that it hardly seems right that they should be thrown over board the moment peace was declared. He thinks that this treatment given the chemists is an additional reason for the formation of a strong organization among the body.

It is expected that within a month's time, the full details of the meetings held in Montreal and Ottawa in connection with the organization of a chemical body will be completed and made public. At the present time, the matter is being put into shape by the committee in charge, but as soon as the details are completed, full publicity will be given to the proceedings.

In a recent address on "Fuel Conservation and Control," Mr. H. M. Marler, Fuel Controller for the Province of Quebec, said that this province had an allotment of 1,090,847 tons of domestic anthracite coal, and that no more will be obtained. Mr. Marler then proceeded to give an account of his stewardship, pointing out the difficulties which faced him in the matter of securing fuel. Quebec's supply was confined to the Pennsylvania fields, and it was not possible for coal merchants of this province to go elsewhere and secure supplies. Mr. Marler pointed out that the whole of Canada was 900,000 tons short of their 1917 allotment. The City of Montreal consumed 891,562 tons last year, while this year its allotment was but 670,698 tons. Mr. Marler repeatedly stated that no more coal could be secured, and pointed out the necessity of conserving the present supply.

CONVENTION OF PULP AND PAPER MAKERS.

The annual convention of the Pulp & Paper Association will be held on Friday, January 31st, 1919, at the Ritz-Carleton Hotel, Montreal. The annual meeting of the Technical Section will be held at the same place on Thursday, the 30th of January. Details regarding the program, etc., will be sent out later.

An Order-in-Council has been passed at Ottawa permitting thorough examination of native copper deposits on the shores of the Arctic Ocean, adjacent to the Coppermine River and Bathurst Inlet. By the same order, the areas in that portion of the Northwest Territories lying north of lat. 65° north and between long. 105° west and 116° west, have been withdrawn from the provisions of the mining regulations.

FOREIGN TRADE ENQUIRIES.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the number of the enquiry. The initials, "B.T.C.," indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

829.—A London firm inquires for the addresses of Canadian manufacturers of dried milk, of which they seek large quantities.

845.—A well-known Mexican brewery requires large quantities of ammonia and malt for the manufacture of beer. Also tin caps with cork for bottles.

846.—A Mexican firm requires varnishes for furniture, powdered bronze for furniture and gilding, hardware fittings for furniture, nails, screws, bevelled-edge mirrors, etc.

847.—A Mexican firm requires felts, wire or wool cloth for paper-manufacturing machines.

850.—Genoa merchant would buy for own account and handle on commission foodstuffs, chemicals, oil seeds. Corresponds in English and knows all Italy.

851.—Genoa merchant would buy for own account and on commission chemicals, soap, soap-making materials.

854.—Commission agent at Turin would represent manufacturers of chemicals, pharmaceutical products, tallow, fats, cocoa.

855.—Genoa representative seeks agency of reliable firm exporting raw materials for all industries, especially oil, greases and chemicals in general.

883.—Rome representative seeks agencies for chemicals, pharmaceutical products, colors, varnishes, oils for colors and lubricants, cotton and woollen piece-goods, agricultural and industrial machinery, steam and electrical motors and apparatus, leather, etc., articles.

884.—Agent at Romagnano, Sesia (Novara), with 100,000 lire capital would handle on commission and for own account, chemicals, pharmaceutical, and colonial products, office sundries, etc.

886.—A British firm of merchants in Argentina, steadily purchasing large quantities of the following articles in New York, would like to receive prices f.o.b. New York from Canadian manufacturers. Confirmed and irrevocable letters of credit are opened in favor of shippers. Articles: Baling wire, fencing wire, galvanized and black, iron girders, merchant bars, galvanized sheets, flat sheets, mild steel bars, nails, high carbon oval steel wire, galvanized piping, black plates, iron fencing standards, galvanized gas tubes, calcium carbide and cotton waste.

887.—A Sydney, N.S.W., firm requiring supplies of unbleached sulphite wood-pulp invite correspondence from interested firms in Canada as per particulars appearing in report from Canadian Commercial Agent at Sydney in this issue.

899.—A Johannesburg firm of engineering merchants, with branch offices and warehouses in each principal centre of South Africa is prepared to take up the representation in this country for Canadian carbide not already on the market.

Chemical, Drug and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

CHEMICAL, DRUG AND METAL MARKETS.

The metal markets are still awaiting developments. In iron and steel, railroad construction and shipbuilding, are sufficient to partly tend to sustain the fixed Government price until such time as investment-buying proper may be expected. This will come when the labor market is stabilized and the political situation in Europe given concrete settlement. Canada has its railway situation better in hand than the United States, and with the advent of the Canadian National Railway System, including the I.C.R. and C.N.R., the Government is able to go right ahead and operate the roads. Up to the end of the year, no great decline was shown in the non-ferrous metal group. The demand for silver shows a shortage, in spite of the high Government price of $1.01 per ounce. Leads shows weakness, the St. Louis price being around $130. There is an active, foreign demand for aluminum, which keeps the domestic firm in the United States, though production is 30 per cent. over last year's record.

When the chemical market is considered, it is the same story. Every one is awaiting developments. There is very little movement. Prices have remained steady, except on such items as toluol, glycerine and war chemicals. Certain intermediates were never plentiful and tend to sustain their price. The larger supply houses are not forcing sales, but are allowing the manufacturers to hold off until they must have supplies, as no large stocks are carried. Unloading may not be in great evidence, although it is expected that prices will be lowered, as we enter the early months of the year.

Canadian Color trade dealers are awaiting supplies long on order. It will be a few months before they can quote prices on a variety of English dyes. The natural dyestuffs remain steady, with no anticipated immediate change. Quebracho shows some decline.

It is understood that a large Canadian Exporting Company is being organized, and that an opportunity for trade is awaiting manufacturers of chemicals and chemical materials who are able to make shipments in large car-load lots. Producers must be able to meet competition on markets other than the United States and Great Britain, and it is expected that Canadian manufacturers will be able to find a profitable outlet for increased production in many lines.

The industrial alcohol situation is gradually improving and very active interest is being shown by Government officials. Cheaper alcohol is essential, and cheaper alcohol will come in the near future for a larger number of commercial users if movements at present under way have any significance. Throughout the whole market, every effort is being made to sustain prices and bring about a gradual reduction, as labor changes from a war to a peace footing.

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28% in bbls.	Lb.	10⅜—.11¼
Acetic acid, 80 per cent. crude	Lb.	—.29
Acetone	Lb.	.50
Aspirin	Lb.	2.80
Alcohol, grain, bbl.	Gal.	8.50
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60
Alum, ammonia, lump	100 Lbs.	6.00—7.00
Aluminum Sulphate, high grade, bags	100 Lbs.	4.00
Ammonia, Aqua 26°	Lb.	.13—.15
Ammonium Carbonate	Lb.	.17—.18
Benzoic Acid	Lb.	3.25
Bleaching Powder, 35% drums	Lb.	.3½—.4½
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.16—16½
Calcium Chloride, fused, in drums	Lb.	.02
Carbolic Acid, white crystals	Lb.	.50—.55
Caustic Soda, ground, bbl.	Lb.	6½—.7½
China Clay, imported	Per ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Coper Sulphate (Blue Vitriol)	Lb.	11½.—12
Fuller's Earth, powdered	100lLbs.	2.00—2.50
Glycerine, drum	Lb.	.40—.45
Hydrochloric Acid, carboys, 18°	Lb.	.2½—.2¾
Lead Acetate, white crystals	(Nominal)	
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, bbl.	Lb.	.22—.25
Magnesium Sulphate	Lb.	.04
Nitric Acid, 36° carboys	100 Lbs.	8¾—.9½
Naphthaline, flake	Lb.	.10—.15
Oxalic Acid	Lb.	.42—.45
Potassium Bromide	Lb.	1.00
Potassium Nitrate, kegs	(Nominal)	
Potassium Permanganate, bulk	Lb.	2.25—2.50
Phenacetin	Lb.	3.90—4.00
Salicylic Acid	Lb.	1 50—1.60
Soda Ash, bags	Lb.	.03½—.04
Sodium Acetate	Lb.	.20—.25
Sodium Benzoate	Lb.	2.50—3.00
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00
Sodium Bichromate, bbls.	Lb.	.20—.22
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.35—.40
Sodium Hyposulphite, kegs	100 Lbs.	4.00
Sodium Nitrate, refined	100 Lbs.	7.00—8.00
Sodium Silicate, according to density	100 Lbs.	3.50—.4½
Sulphur, ground	100 Lbs.	3.00—3.25
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	2.50—2.70
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	.95—1.00
Tin Chloride, crystals	Lb.	.50—.55
Zinc Sulphate, com.	Lb.	.6½

Metals.

Aluminum, No. 1, 98-99%	Lb.	.45—.50
U.S. Government price, in 50-ton lots for ingot 90-99% A1	Lb.	.33
Antimony	Lb.	.07—.12
Brass, yellow ingots	Lb.	.18—.20
Brass, red	Lb.	.21—.25
Cobalt, metal	Lb.	2.50—3.50
Cobalt Oxide, grey	Lb.	1.65
Copper, casting	Lb.	.25
Copper, electrolytic	Lb.	.25
Copper, Am. Government price (electrolytic and casting)	Lb.	.23
Iron, common, base price	100 Lbs.	5.00
Lead	Lb.	.09
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure Government price	Oz.	105.00
Silver, bar (U.S. Govt. price)	Per troy oz.	1.01⅛
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.25
Steel, nickel, in bars, 3½% nickel	Lb.	.25—.27
Steel, sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	.75—.80

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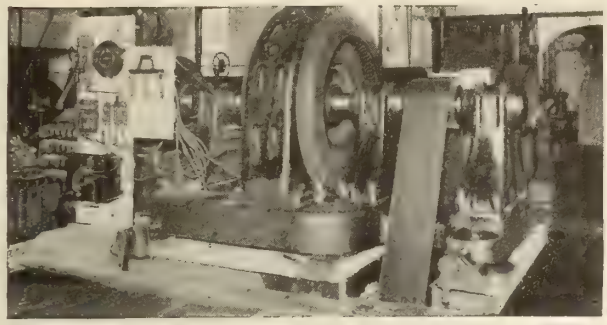

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PROPOSED ESTIMATES AND PLANS OF CENTRAL RESEARCH INSTITUTE.

The Honorary Advisory Council for Scientific and Industrial Research have recommended the expenditure by the Government of $500,000 for the purpose of constructing a four-storey building of the laboratory type, to serve as a Central Research Institute. The building recommended provides for a basement in addition to the four storeys. It should be of steel construction, and have cement floors. The estimated cost would include the heating plant and power equipment, as well as the ventilating outfit and the water, gas, plumbing and draining. An additional $100,000 would be required for scientific equipment. Another $100,000 would be required for salaries, although only a small part of this would be used the first year. The Council strongly recommend that a director of the Research Institute should be appointed before construction begins, so that the work might be properly supervised.

The proposed building would contain fifty laboratory rooms, 25 ft. by 25 ft., in addition to corridors and office and administrative quarters. The suggested locality is in the vicinity of the Experimental Farm, near Ottawa, on a fifty-acre site, so that a city water supply and electric power would be available, and there would be room for future expansion.

It is proposed that the Research Council, which would be the governing body of the Institute, should make all appointments and determine the salaries of the staff, subject to the approval of the sub-committee of the Privy Council for Scientific and Industrial Research.

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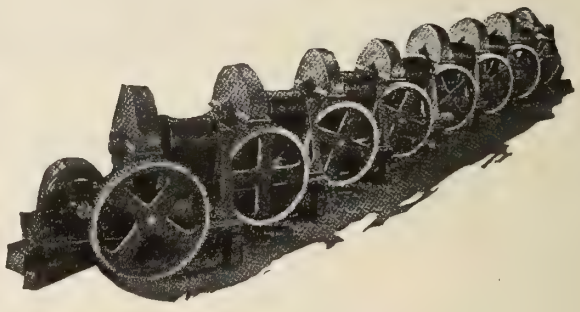

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DOMINION POWER BOARD APPOINTMENT.

Mr. Arthur Amos, Chief Engineer of the Hydraulic Service of Quebec and a member of the Quebec Streams Commission, has been elected to the Dominion Power Board. A conference is to be held early in February, at which the development of the St. Lawrence River for navigation and power wil be one of the most important problems discussed.

TORONTO UNIVERSITY WAR MEMORIAL.

Five hundred thousand dollars has been suggested by the University of Toronto Alumni Association as the objective to provide a University War Memorial. Half of this amount would be devoted to maintaining scholarships for returned soldier students and other undergraduates, the other half to be used in erecting a memorial to Varsity's fallen heroes.

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of THE CANADIAN CHEMICAL JOURNAL.

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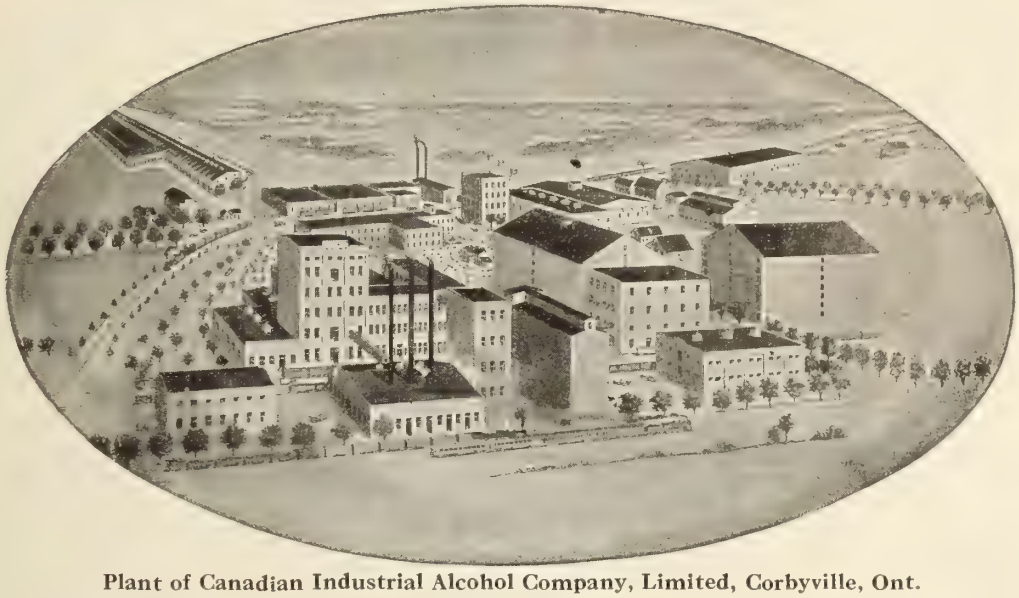

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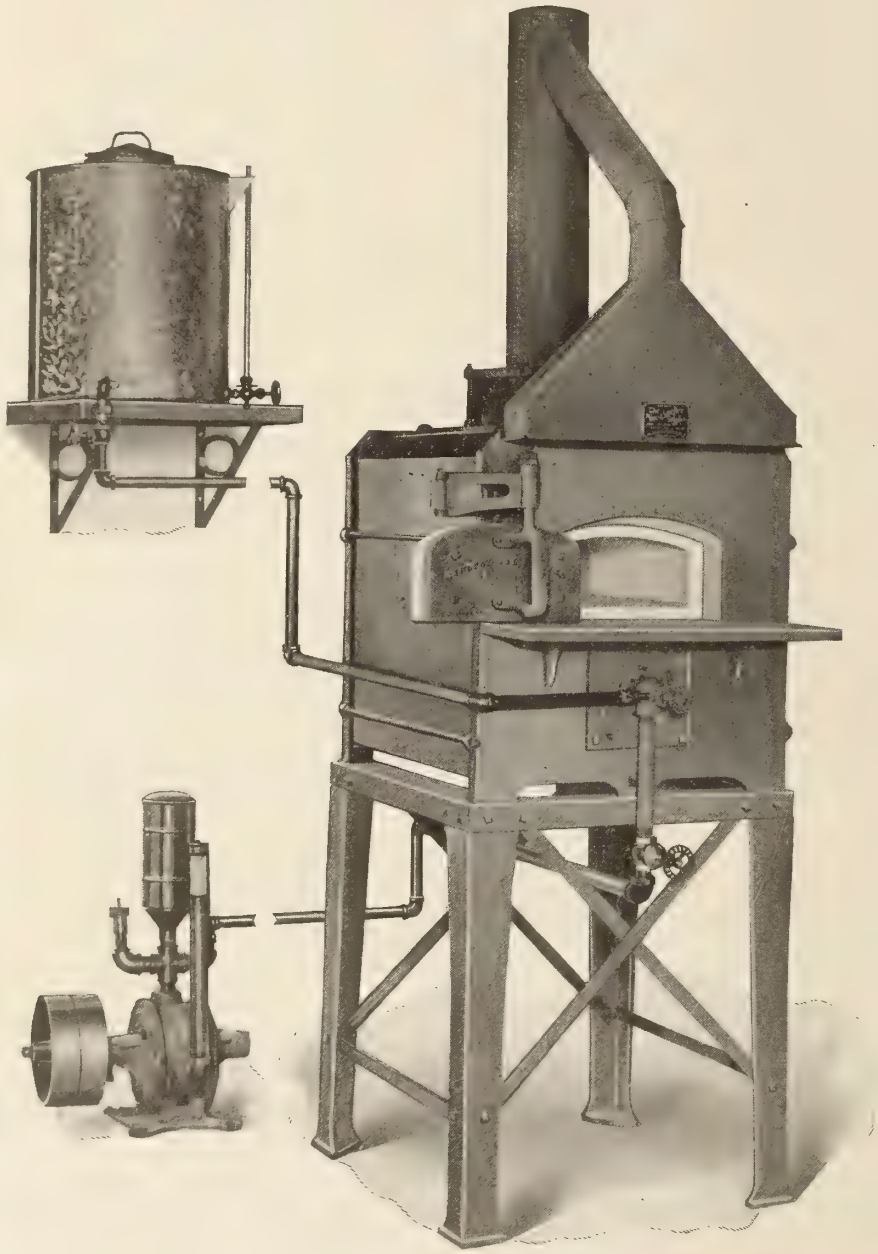

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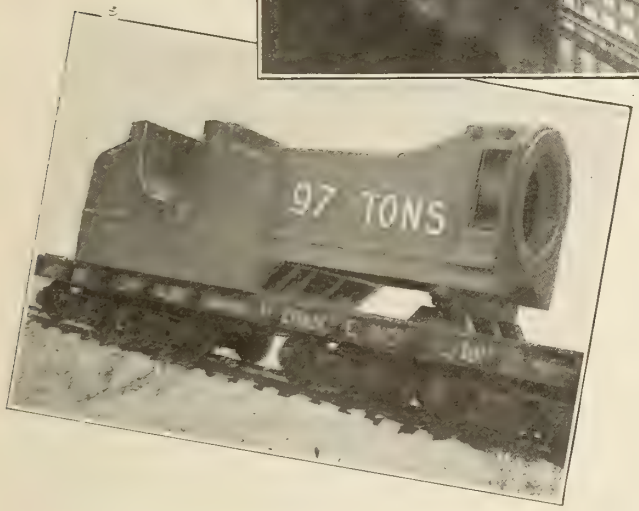

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Ontario abounds in waterpower, now in many places being transformed into hydro-electric energy for manufacturing, mining and metallurgical purposes. Many localities are capable of becoming industrial centres for the transformation of raw materials into finished products by electro-chemical and electro-metallurgical processes. A striking example is the area contiguous to the great cataract of Niagara.

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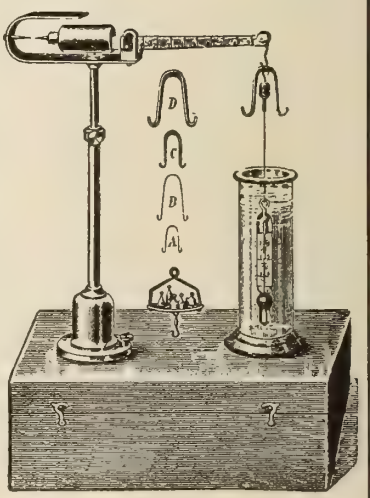

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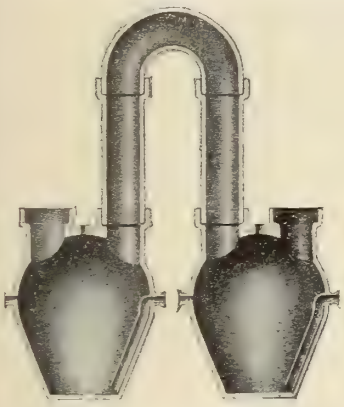


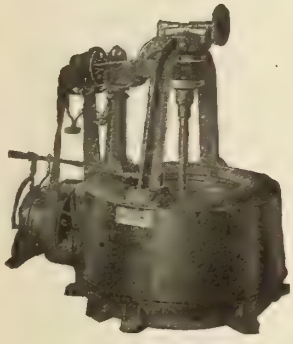
CHEMICAL STONEWARE

ACID PROOF BRICK ACID PROOF RINGS
ACID PROOF APPARATUS of all Kinds

Our stoneware is vitrified and covered with an acid proof glaze

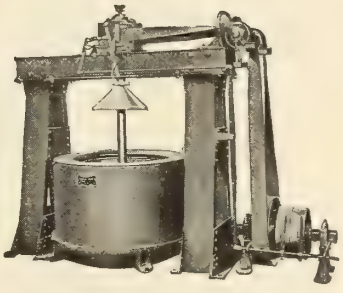
ASK FOR CATALOGUE

The Toronto Pottery Company, Limited
TORONTO - - CANADA
Canadian Branch of THE ROBINSON CLAY PRODUCT CO.
AKRON - OHIO



Tolhurst Centrifugals

for



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TOLHURST MACHINE WORKS

ESTABLISHED 1852 New York Office, 111 Broadway TROY, N.Y.

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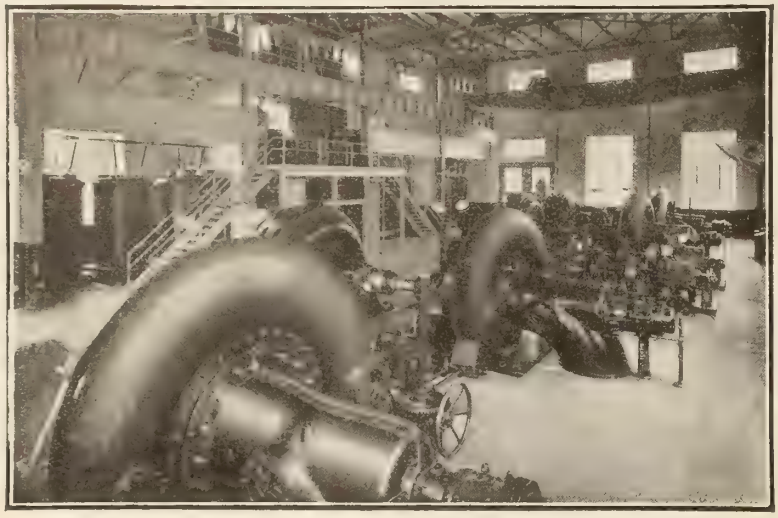
HYDRO-ELECTRIC POWER PLANTS



WE design and build hydro-electric power plants of all sizes and types, and from a given head of water are prepared to guarantee a definite electrical output.

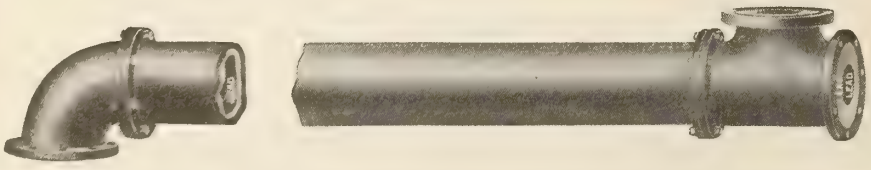
The illustration shows four of our single horizontal turbines, each 6,000 h.p., 630 r.p.m., 410 ft. head and two exciter impulse wheels each 225 h.p., 900 r.p.m., 380 ft. head.

CANADIAN ALLIS-CHALMERS, LIMITED

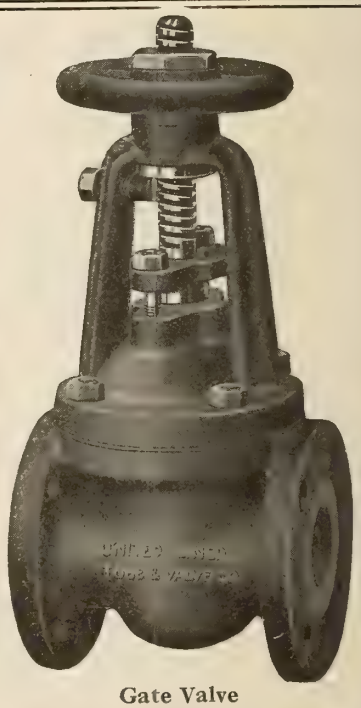
Offices: Toronto, Montreal, Quebec, Halifax, Sydney, Ottawa, London, Cobalt, South Porcupine, Winnipeg, Calgary, Edmonton, Nelson, Vancouver

Acid-Proof Pipes, Fittings and Valves

Lead Lined Expansion Bend



Section Flanged Pipe and Fittings



Gate Valve

A varied line of pipes and accessories for handling acids and corrosive chemicals. Our products are installed in many of the largest chemical plants in America. Catalogues on application.

HOYT METAL CO., - TORONTO

Canadian Representative of the UNITED LINED TUBE & VALVE CO., of Boston, Mass.

Acid-Proof Equipment

that is

ADAPTABLE

THE clinching, satisfying Fact about PFAUDLER Glass-Lined Steel Equipment is its **ADAPTABILITY** to exact needs. Outlets and inlets can be had in just the number and at the exact locations required. If a jacket is needed it is made to just the height you want. If you need outlets through the jacket you may have them. If you desire to handle substances such as edible fats which solidify when cold, your container may be made with Jacketed outlets so that **all** of the contents may be warmed up after storage when it is desirable to draw off. In other words, because we are dealing with metal we can achieve almost any shape or design.

Superior to Stoneware

Adaptability is only one of the qualifications of Pfaudler Equipment which makes it superior to Stoneware, but it is this feature which makes it possible for many of our customers to have their containers so designed that they may serve a variety of purposes.

"Three-in-One"

In this space next month we shall picture a small PFAUDLER Acid-Proof Enameled Steel Tank that serves its owner for **three distinct operations, Distillation, Evaporation** and **Dissolving** and **Mixing**. We shall tell just how he uses it, the nature of the solutions and mixtures handled and we shall give in his own words his experience with it and his opinion of it.

The PFAUDLER Co.

ROCHESTER, N. Y.

New York Chicago San Francisco Detroit St. Louis

"VALLEIRON APPARATUS"

NITRIC ACID RETORTS FUSION KETTLES
SULPHONATORS AUTOCLAVES
ACID EGGS CAUSTIC POTS, Etc., Etc.

VALLEY IRON WORKS

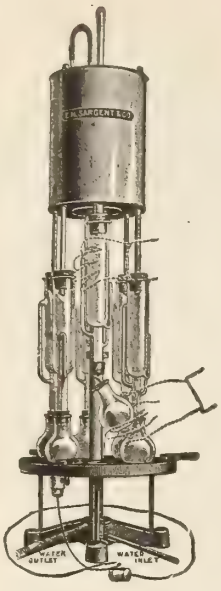
Williamsport, Pa. - - - - U.S.A.

Dorr Equipment for Soda Recovery

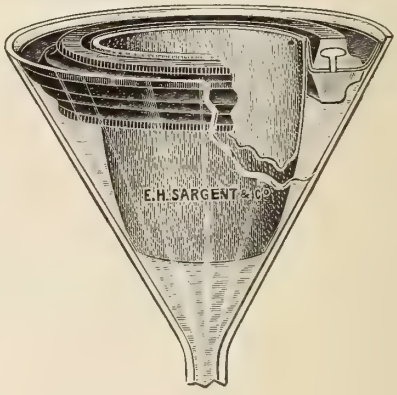
Our continuous causticizing system is peculiarly well adapted for re-causticising the return liquor from soda recovery plants. While to date it has been employed in this way only in connection with the Soda Pulp process, we are satisfied that it is equally as well adapated to the Sulphate Pulp Process. Our engineers are prepared to investigate particular conditions

THE DORR COMPANY
ENGINEERS

NEW YORK 101 Park Ave. | DENVER 1009 17th Street | LONDON 16 South St.

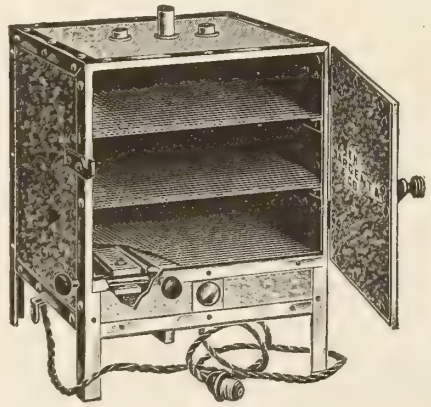


WHILE enjoying a very flattering patronage of long standing in Canada, we desire to extend our acquaintance in the Dominion among users of Chemical and Bacteriological material.



In addition to our large stock of supplies for the scientific patron, we have to offer unusual facilities derived from years of experience in these lines (established in 1852) including an intimate knowledge of customs requirements in the way of official forms for Invoices and Manifests.

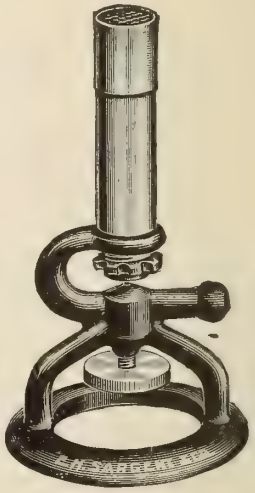
We also maintain a corps of experienced technicians whose services are at the disposition of our customers in the matter of the selection of apparatus or chemicals and reagents, and with whom correspondence is invited, and whose experience may be of much service in the matter of manufacturing special apparatus.



---Special facilities are offered by our own factory.

---A few pieces indicative of our lines are shown.

---Specialties will be described in future issues.



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Black Varnish	Naphthalene	Shingle Stain Oils
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Dominion Tar & Chemical Co.

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Benzol Recovery Plant, Sault Ste. Marie, Ont.

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Address all communications to Sales Office, Sault Ste. Marie, Ont.

"The celebrated impervious body of the United States Stoneware Company's stoneware is due to the exclusive clay of which it is made."

Acid-Proof Chemical Stoneware and Bricks

The Judge before whom a case is up for trial in court gives careful attention to all the testimony and renders his verdict accordingly.

This is not a matter of a case in court but it is a matter of where to obtain the most serviceable **Acid-Proof Chemical Stoneware.**

The U. S. Stoneware Co. guarantees this service. Its great volume of customers supply the verdict.

—Everything in Chemical Stoneware and Bricks.

—Our Elaborate Catalog at your Command.

—Prompt deliveries.

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ESTABLISHED 1865

AKRON, OHIO, U. S. A.

Have You Read It ?

We are referring to our latest bulletin on the Ingersoll-Rand Vacuum pump; the vacuum pump with the plate valve of maximum efficiency, and the careful construction you are accustomed to find in all C-I-R-Co. products.

We cannot tell you all the good points of this machine here—if you are really interested in the construction points of a first class vacuum pump write us for a copy—ask for Bulletin 3137.

CANADIAN INGERSOLL-RAND CO., LIMITED

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And at SYDNEY SHERBROOKE TORONTO COBALT
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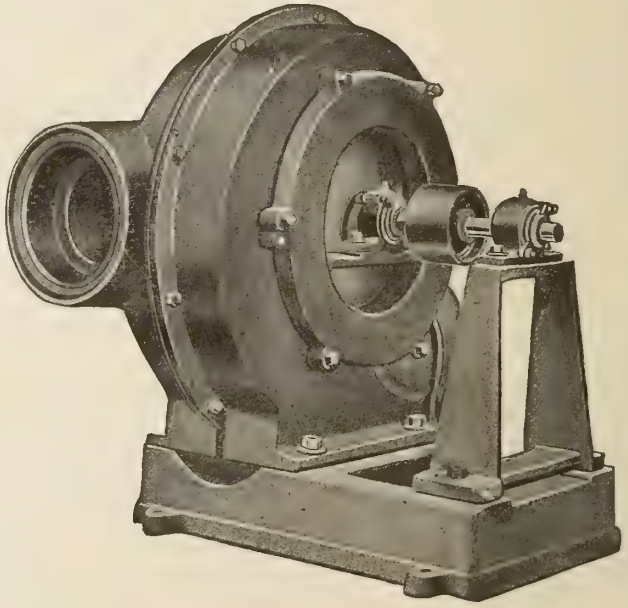
Acid Proof Apparatus and Machinery known all over the world for excellence of material and workmanship

FOR HANDLING ACIDS AND OTHER CORROSIVE MATERIALS

The Best is none too Good



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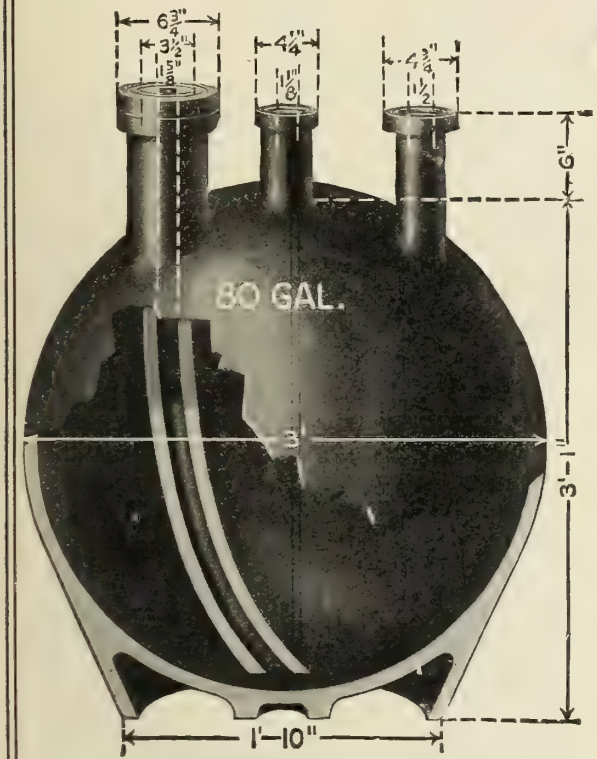
"The Glaze Often Covers a Multitude of Sins"



STANDARD 80 GALLON BLOWCASE
We also make a standard 45 gallon size and any other size to order. Inlet and outlet cocks with piping also furnished.

MAURICE A. KNIGHT
ACID PROOF CHEMICAL STONEWARE
AKRON, OHIO, U.S.A.

It's In the Body

Knight Acid-Proof Chemical Stoneware does not depend on glaze, enamel or veneer.

Its Acid, Alkali and Chemical resisting qualities are found **in the body itself.**

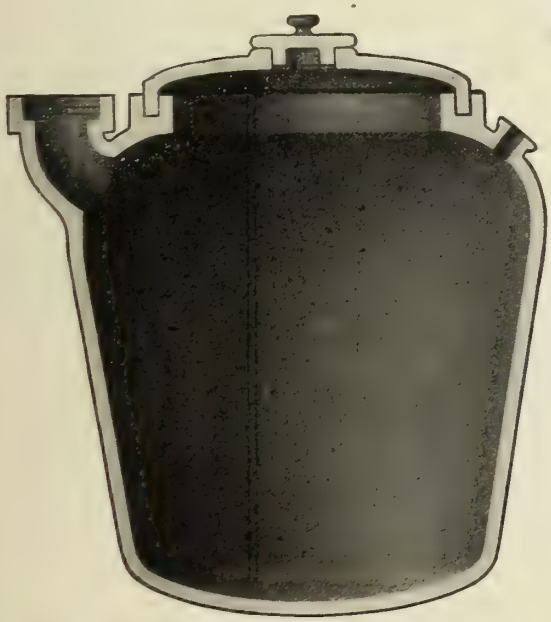
Our entire organization has been making Acid-Proof Chemical Stoneware *of every description* for over ten years.

Cheapness cannot guarantee quality — Knight Acid-Proof Chemical Stoneware is *guaranteed.*

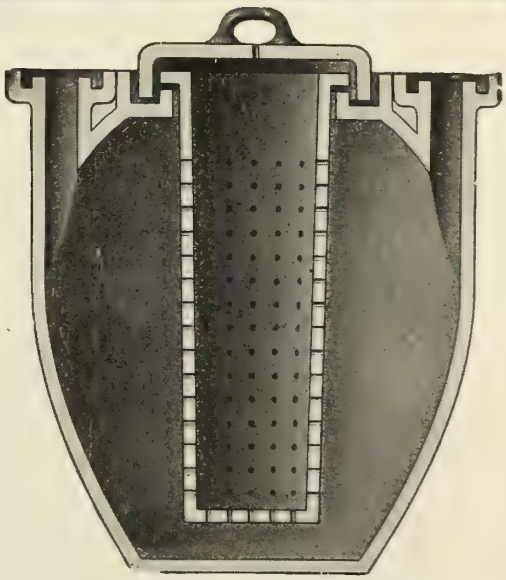
MAURICE A. KNIGHT

Acid-Proof Chemical Stoneware of Every Description

Office and Factory:
Kelly Ave., East Akron, Ohio



Acid-Proof Nitrating Kettle made in any capacity from 50 to 250 gallons. Cover and outlets or inlets made to meet requirements.



Chlorine or Gas Generator furnished with or without basket and cover. Made with inlets and outlets as desired. All designs of Receivers.

Our ware is NOT the cheapest, nor is it fancy, but it is GUARANTEED to be acid proof, free from defects, not to leak or sweat, and to be perfectly satisfactory in every respect.

What does our One Price Policy mean to the user of Laboratory Supplies?

It Means

FAIRNESS
PRICE BASED SOLELY ON COST AND NO ONE RECEIVES A BETTER PRICE.

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Vol. III, No. 3 TORONTO, MARCH, 1919 20c. a copy.

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BENZOATE OF SODA B.P. and U.S.P.

BENZALDEHYDE, technical.
95 per cent. aldehyde contents.

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OF CANADA, Limited
WALKERVILLE - ONTARIO

Representatives for Eastern Canada : Messrs. T. E. O'REILLY, LTD., TORONTO

NEWS FROM THE INSTRUMENT SHOP

(Being the fourth and last of a series of advertisements by Eimer & Amend, setting forth their chief attainments during the war.)

The uncommon achievements of our instrument shop during the past few years readily fall into three groups:

FIRSTLY, the experimental work on various apparatus for use of the American and Allied Military Forces.

SECONDLY, the rebuilding and refinishing of imported apparatus—some pieces could not be replaced on account of the lack of essential parts, while other pieces possessed sufficient salvage value to warrant reclamation.

THIRDLY, the building of complete instruments and apparatus to replace those of foreign manufacture. This third class, as well as the second, was carried to the point only where it would not conflict with the more important business of helping to win the war.

WORK ordered by the Government and done directly for it was perhaps the most interesting. Our files for 1917 and 1918 contain countless orders from the Gas Defense, Gas Offense, the Army Medical Schools, the Aviation Fields, the Medical Supply Depots, etc., for apparatus and devices of many special kinds "as per instructions to the Machine Shop." This labor was not limited to experimental work, but quantity production was also effected, as evidenced by the fact that thousands of gas detectors used by the American Army on the fields of France bore our trademark.

THE Sugar industry was greatly inconvenienced by the inability to procure French or German polariscopes. When the consequences had assumed a serious aspect, we undertook to remodel a Schmidt & Haensch instrument, including repolishing, cementing and repairing of the prisms. The results were so highly pleasing to our customer that we secured a continuous flow of orders of this kind from all over the sugar-producing sections of the United States, Cuba and Porto Rico. To the best of our knowledge, all the polariscope observation tubes produced in the world during the past two years (except those, if any, turned out by our enemies) were made by us.

AMONG precision instruments of similar class which we have taken the time to dismantle and remodel, let us mention Wanner pyrometers and Zeiss microscopes, including their objectives.

WE have manufactured **completely** Beckmann boiling point and freezing point apparatus; Duboscq colorimeters, quite like the original French, and, we think, better; Juerst ebullioscopes, to replace the Salleron; and also a number of other intricate physical apparatus.

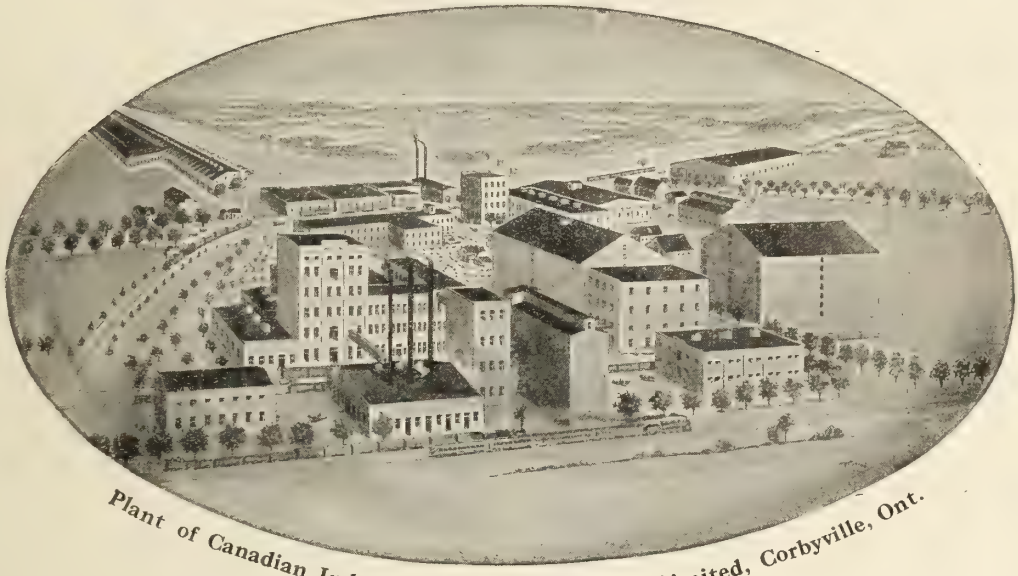
IN addition to these, we have maintained and increased our normal output of such well known specialties as the three types of Young's specific gravity instruments (two styles embodying displacement plummets of incomparable accuracy) excelling in sensibility the highest class of analytical balance; Kimley electro-analysis apparatus; Gramercy stirrers, and many others.

THE capabilities and the facilities that raised this shop and its work above others of its kind are now available for the solution of problems like in nature to those indicated by the foregoing resume.

EIMER AND AMEND

New York and Pittsburgh

ALCOHOL



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With a capacity of 450,000 (proof) gallons per month we are the largest producers of Alcohol in Canada.

Manufacturers of vinegar, perfumes, essences, pharmaceutical preparations, etc., are invited to write us for prices of Alcohol suitable for their particular line of business.

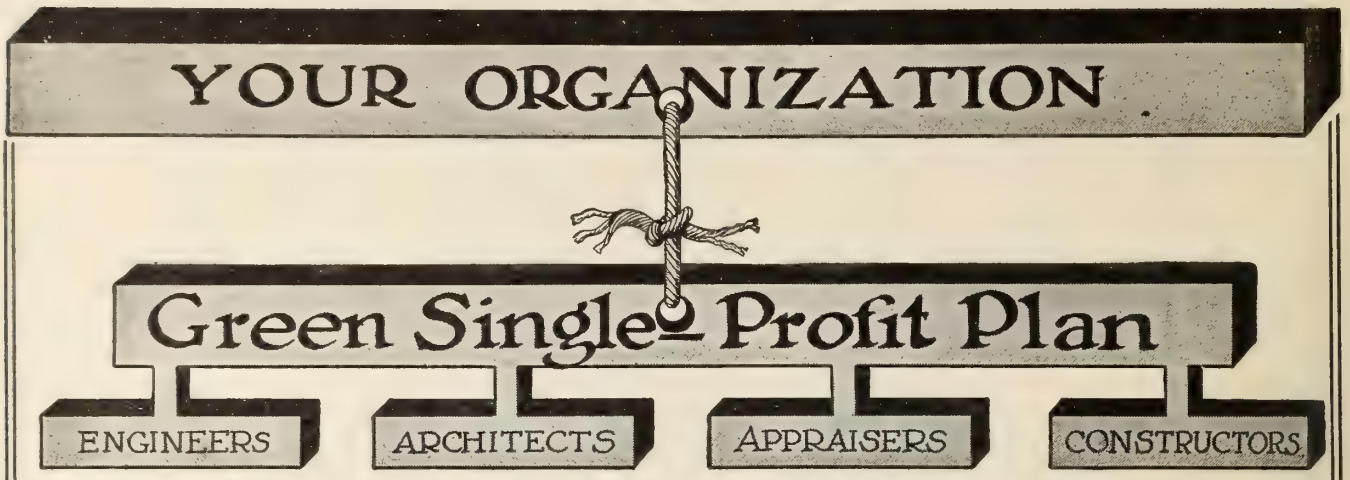
We make a special feature of contracting for the requirements of manufacturers for the year or season, thus providing not only a uniform cost but also a steady supply as needed.

Those who are using Duty Paid Alcohol in their manufacturing processes would do well to consult us with a view to using it "In Bond," thus avoiding the use of two-year-old Alcohol. Under the rules and regulations of the Department of Inland Revenue, newly made Alcohol may be used "In Bond." This Alcohol is much cheaper than two-year-old.

METHYLATED SPIRITS or Denatured Alcohol is sold only by the Department of Inland Revenue, Ottawa, Ont., but any other kind of Alcohol may be secured from us.

Canadian Industrial Alcohol Co., Limited

MONTREAL, QUE.



Tie this to your organization when you wish to build or expand

It will mean a considerable saving in cost to you.

A saving not only in the cost of the building, but also in the equipment, if you care to have us go that far. We are prepared to handle all of the work, or any part of it—design, construction, equipment and management.

We know that you can save money by the Green Single Profit Plan, and at the same time have the entire work done, according to the highest engineering standards.

At your request and without obligation to you, our competent representative will call and explain the interesting way in which the Green Plan works to your advantage.

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OF ALL KINDS

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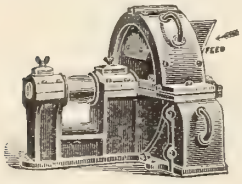

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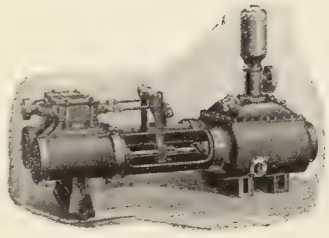

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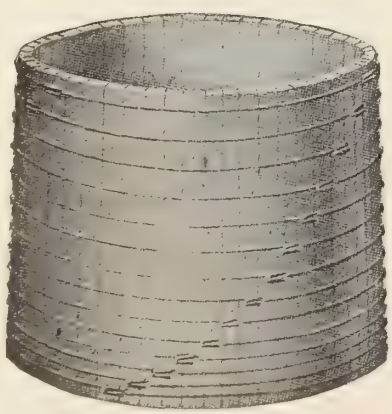

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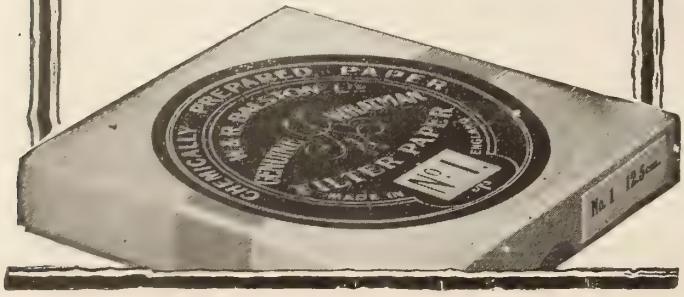

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TO OUR SUBSCRIBERS.

We thank our readers for their promptness in renewing their subscriptions for 1919. It is gratifying to record an increase of 300 in our circulation since December.

To provide ample accommodation the publication offices will be moved this month to Nos. 411 and 412 Manning Chambers, 68 Queen Street West, where we will welcome the friends of the Canadian Chemical Journal.

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Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

ONE REAL SOLUTION OF WORLD LABOR PROBLEMS.

OUR chemists, artists, poets, preachers, doctors, and a number of such professions, have so far never become organized for the purpose of stopping their labors at a moment's notice. At any period during the last four years the loss of the labor of chemists and trained physicists would have ruined our cause as much as any other possible single disaster.

Now these men are not over-paid. In fact, many of them are decidedly lacking in the financial rewards which their labor should bring in. There is something deeper than this behind their dogged duty to service and science. There is a secret here which a labor troubled world may yet discover. Research men do not strike; further than this, their assistants and helpers seem to catch their spirit too. Neither force nor necessity will hold men at their work beyond a certain point. There must be elements in the nature of the work and in the attitude of mind of the man which sustains his efforts. These labor units are strikingly personified by the operations of the larger research laboratories of the world. Here is a spirit of co-operation which produces and creates in an atmosphere where there is no "boss"; where men lead and others follow because the leader is produced naturally.

Pure science has joined hands with business and applied research. Applied research has joined up with factory production, and the real solution of labor difficulties lies in the saturation of the factory with the spirit of the research laboratory and a part of its method.

A new kind of education, coupled with a new method of factory control, can alone produce that harmonious relationship which must essentially exist between every man and woman in the organization. The production of genuine interest in the work, something akin to that which keeps the chemist alive and interested, must be transferred to the honest workman, and for his benefit machinery must be found whereby his capabilities may be developed

and his powers of observation broadened, stimulated, and encouraged.

We in this country are doomed to disappointment if we believe that real progress can be made by any other means. We rush to Europe to seek a market, only to find that doors are closing fast upon channels which for the moment looked promising. The methods used in our industrial development have in the past been based on the principles of the separator, skimming the cream and selling it at a low price; or perhaps better, those of a certain animal—the bull. These are not popular solutions of difficulties now facing the business world, and the growth of these conceptions involve long time factors.

There is no country so land-locked or so badly impoverished for lack of natural resources but which could command the wealth of the whole world if the Research Powers of its laboring classes and mental leaders were but a fraction in advance of those exercised elsewhere. Such a statement is but the summation of history. Were these conditions to prevail throughout the majority of our industries happy solutions would follow naturally for the most of our labor troubles. When the bones of our ancient systems are rattled in this way, and this way only, we will be off to a fair start on a new era in the history of the human race. Dwelling upon the possibilities of Chemical Research and turning from these to the applications of research thinking confirms one in the hopefulness of this idea. Sociology and industrial research may yet discover this common ground.

SHOULD RESEARCH INSTITUTIONS BE CENTRALIZED?

OPINIONS differ considerably regarding the methods which should be adopted in building up research institutions. We in Canada are committed, in a sense, to the idea of centralization. In the United States the pendulum has swung backwards and forwards, and at the moment legislation is being discussed in the shape of the Smith-Howard Bill, which, if adopted, will tend to decentralize further research efforts and build up the universities.

The program, as outlined in this bill, would make it optional with any University, College, or equivalent technical institution whether or not they accepted the Government grant. This would amount to $15,000 the first year, and would increase to a maximum of $30,000 in three years. In this way it would be possible to finance much valuable industrial research work locally, and perhaps allow a larger number of students, professors and industrial men to co-operate advantageously.

For a time in certain American Government departments there was a tendency to establish laboratories in every State. Then a time came when Washington was the centre for everything; the States, of course, carrying on their own scientific work. Recently, however, the idea of voting money for the support of Colleges and Universities, and in this way building up fairly large research institutions locally, has seemed to be the best procedure, in the opinion of research leaders and those following these movements in the United States.

Many arguments may be used in support of various methods of accomplishing the desired aim. The large institution is far from the application of its work. It tends to be a one man institution to a certain extent, and more than the proper stress may be given a certain line of work. On the other side much may be said for the centralization plan. Perhaps for the United States both ideas may be worked out and good results obtained from their large central organizations at Washington, as well as from any smaller centres that may be put into active operation.

In Canada it is a question of starting something—not one of choice between the making of a large institution larger or the creation of a number of smaller ones. The plans adopted for building up a Central Research Institute at Ottawa are good and should be carried out. It is a question, however, if even the expenditure is really all that should be made immediately. Our Universities should not suffer because we have a Central Research Institute at Ottawa. The giving to an individual of a few hundred dollars per year as a salary for carrying on research does not assist the Universities greatly. Direct cash grants must be made of really respectable sums of money before they can begin to handle the work that would be profitable. The central idea is necessary, but no more valuable results are likely to be obtained than by stimulating our university departments. Our industrial research schemes must be composite and adaptable.

PULP AND PAPER ASSOCIATIONS.

IT is certainly a pleasure to record the growth curve of these associations. Both in the United States and Canada everyone connected with these industries is enthusiastically planning bigger, better, and more economic developments for the men in the industry, and the materials upon which they operate. When an industry such as this begins to see daylight the sun may be expected to rise rapidly.

The possibilities of scientific research as applied to the paper industries were thoroughly treated, both at the New York and Montreal conventions. It is not beyond reason that profitable industries now not thought of may be built up around the pulp and paper industries, just as similar industries surround coal tar. Investigators are meeting difficulties; they are few in number, and it is possible that insufficient attention has been given in the past to the large

possibilities of using non-cellulose materials. This, at least, was the opinion as expressed at the New York meeting last month.

At the Montreal meeting many good papers were given before the technical section. The question of alcohol from waste sulphite liquors was taken up by Dr. Krieble of McGill University. The importance of this industry is not yet appreciated as it should be in Canada. Dr. A. E. Nielson of Chicago gave a paper on "Morterud System of Indirect Cooking as Applied to Sulphite Pulp." Perhaps the most modern movement yet made by the paper industries has been along educational lines. Technical associations, both in New York and Canada, have approved of the plan and $30,000 has been promised. The organization of this educational work has already been partly worked out. Texts and courses of study are in preparation. It is a broad scheme and any industry with such money invested should not hesitate to expend several thousand dollars, for it is obvious that without such an investment by someone, but slow progress may be made.

There are many chemists finding their life work in these industries, and many more could be absorbed. Norway and Sweden have supplied us with many highly trained men, but there remains no excuse now if we do not develop Canadian trained technologists and research chemists for our paper industries in larger numbers than ever before. With such an assured market in the United States and foreign countries it becomes a public duty to foster scientific research in this industry, to the end that Canadian brains may place on a truly economic basis, the utilization of one of our greatest sources of national wealth.

ONTARIO OIL SHALES.

MUCH has been written regarding the development of an oil shale industry in Canada. The shales of New Brunswick have received more recent attention than those of any other district. There are fashions in Geology, as well as other things, and much scientific work has been done by individuals simply following the crowd.

From time to time the shale deposits of Ontario have been mentioned, and are in general reported as being unsuitable for development. There remains, however, one district which many years ago had reached the producing stage, and was then lost sight of completely owing to economic conditions which perhaps no longer exist. In the region of Collingwood, Ontario, a plant was established for the distillation of oil shales as early as 1859. In the Geological Report of Canada, 1863—p. 784-5, the following account is given of operations then under way:

"In 1859 works for obtaining these oils were erected on the locality of this shale near the town of Collingwood. Twenty-four longitudinal cast-iron retorts were set in two ranges, and heated by means of wood, of which 25 cords were said to have been required weekly. The shale broken into fragments was heated for two or three hours, from eight to ten charges being distilled daily and made to yield 250 gallons of crude oil, corresponding to about three per cent. of the rock. By a farther continuance of the heat a small additional proportion of oil was obtained from the shale; but it was found more economical to withdraw the charge after two hours and a half. The bed of shale available for the purpose adjoins the works and was furnished, ready broken, at twenty cents the ton. The cost of the crude oil from the shale was stated by the manufacturers to be fourteen cents the gallon. When rectified and deodorized it gave from forty to fifty per cent. of burning oil, and from 20 to 25 per cent. of waste; the remainder being a heavy oil fitted for lubricating purposes. After two or three unsuccessful trials and repeated destruction of the works by fire, they were at last, in 1860, got into successful operation and a ready market was found for the oils. Data are, however, wanting to show whether the enterprise was remunerative, and it was after some time abandoned, partly it is probable on account of the competition of the petroleum of Enniskillen, which was about that time brought into the market in large quantities and at a very low price. Should it, however, at any time be found advantageous to renew the experiment of distilling the bituminous shales of this formation, those of Collingwood offer very favorable conditions from their accessible position and also from the ready means of transport afforded both by the lake and railway."

From the above, written as it is in a style not now in common use, it would seem that Ontario has but to read her history to re-discover valuable natural resources which have been long forgotten. Perhaps some future party of geologists will again investigate these oil shales of Collingwood. If in due time capital is attracted and Collingwood is presented with a new industry, we wish no one to forget the work of certain early Canadian Chemical Engineers who erected "twenty-four longitudinal cast-iron retorts," some sixty years ago, to the honor and glory of the great shale oil industries of Canada that are yet to be.

GOLD, SILVER AND NICKEL DEVELOPMENTS.

GREAT natural resources are not always properly appreciated by those who possess them. To a certain extent this is true at the present time in reference to the three great leading metals being produced in Ontario. The relationships of

these three products to commerce and industry are most complicated.

In general, conditions in the silver and gold camps of New Ontario were never brighter. Exploration work has been rewarded and as labor becomes available and costs ease up, there is certain to be a production of gold and silver from our Ontario mines which will more than break all previous records. Without argument, it is sufficient to state that gold production should be directly encouraged. India seems likely to remain a bottomless pit for silver. It has already devoured the American silver dollar coinage. The nature of the assistance that might be given districts where preliminary showings indicate values should come rather in the form of better roads and means of transportation than in a bonus on production. The subsidizing of low grade ore propositions is not a practical or economic method of developing such resources as we have available above North Bay, at least this is not the first step. There are districts, such as Gowganda, Wasapika and West Shining Tree and Kirkland lake, where railroad connections would more than likely open up some very high grade ore bodies, or, if these were not found, certainly a number of good paying lower grade prospects. In this district, and twenty-five miles from the railroad, is situated one of the best silver mines in the North country—the Miller Lake O'Brien. Supposing a pound of ore had never been shipped from any of these districts, the railroad construction would have been justifiable, inasmuch as agricultural anl lumber resources are made available.

Our Ottawa mint has been busy during the war, and we trust that everything will combine to keep the chlorine pots frothing and the real gold bricks piling up. The production of refined silver and by-products are well established Ontario industries.

During the war period the nickel situation took a complete turn over as far as American firms were concerned. The action of the Ontario Government in bringing refining industries to Canada, unfortunately, did not extend to companies shipping concentrates to England. Nickel, of course, is one of those political metals. The momentary tendency to lower the nickel production is but the reflection of general conditions. The normal production of nickel in Canada is likely to increase. The revenue to be gained through complete refining in Canada amounts to such a visible fraction of the interest on our war debt that movements in nickel are likely to be kept well before the public eye. There is a lot in the theory that Canadian nickel should be completely refined in Canada. It is hardly fair to say that part of it must be and the remainder may be treated in this country. If the habit of wall building grows and each country attempts to pay its war debts by crowding its own shell and fasting itself fat, these items—gold, silver, and nickel, and those which occur with them—cobalt, platinum, and palladium, will have to hold just a little more of the line for Canada.

THE TEACHING APPLICATION OF MOVING PICTURES.

OUR educational system in Canada is being attacked from every possible angle. Most strenuous efforts are being made to satisfy the demands of modern life and keep pace with them. These movements are disturbing the well-established organizations of our schools and universities. Doubtless there are real causes and shortly there may be tangible results; in the meantime, all is confusion. Our system is at the end of a period and hesitates slightly before the new day's work.

We have watched the growth of what might be called the industrial application of moving pictures. The Dominion Government has demonstrated abroad and at home the natural beauties and business of Canada as a purely advertising proposition. Many companies have had their processes displayed at conventions, exhibitions and technical lectures. Among the chemical industries the Canadian Electro Products Co., Montreal, and the American Cyanamid Co., of Niagara Falls, have at various times interested audiences in this way. The Ottawa branch of The Society of Chemical Industry has introduced moving pictures at their meetings and the general practice is becoming much more common as various industrial films become available.

The application of this idea to university teaching should soon come. As applied to industrial chemistry it would be only necessary to have a series covering a number of different industries and plants. These could be circulated among our leading American and Canadian universities. An hour each day spent viewing such industrial films would be easily the equivalent of much travel and study. As a means of supplementing ordinary courses and broadening the mind of the student, such lectures would be of great value. All that is necessary is some co-operation between universities and perhaps a little special support. Practically all our industrial firms would be willing to allow views of their plants to be taken. We simply suggest this idea now, believing that in a very short time such moving picture lectures will become a regular part of many of our university courses.

AN OPPORTUNITY—THE 1919 CONVENTION OF CANADIAN CHEMISTS.

SOME people need more perspective than others before grasping the significance of events. There are movements under way which have a direct bearing on the business and life of every Cana-

dian, or foreign chemist working here. Last May, at the Convention of Canadian Chemists held in Ottawa an important committee was appointed and machinery created to further the interests of an organized chemical profession in this country. Every province is represented and both French and English chemists have met together to discuss these problems. During the year this committee has done good work under difficulty and will bring before the next convention in May a full report upon which, it is hoped, organized action will be based.

If there remains one single chemist in Canada who does not realize that these movements vitally influence his work, his pay, and his rightful recognition, it is time for this gentleman to accelerate his mental processes. The capacity for working together in unison and harmony for the general benefit of the profession is something that should be cultivated. There are so many sub-divisions of chemistry that a certain difficulty arises in finding common ground whereon a pulp and paper chemist may meet the man interested in iron or steel. But greater difficulties than these have been overcome many times before, and should not halt men of purpose. Most chemists have had at least four years' preliminary training along common lines. This should be a lasting link, even if there were not many other common points of contact.

The opportunity, then, which presents itself to the Canadian Chemist in Montreal next May is simply one for organization. We have two distinct sections of the Society of Chemical Industry, and provinces represented by organizations of local growth. We have many members of the American Chemical Society with no social organization in Canada, and a number of chemists, interested in particular in the paper industries, who have an organization suited to their immediate needs in the technical section of the Canadian Pulp and Paper Association.

A group of professional men, who are leaders in chemical research, teaching, engineering, and industrial laboratory practice, is needed as a nucleus to give strong support to their own work and the industrial research so necessary if the aims of the Government are to be realized. The educational force that might be brought to life by such an organization is very much needed at the present time, and the great fundamental truth that those who assist in helping any good cause are themselves broadened, is true of the proposed movement. Many chemists, however, must overcome their inertia. Organization among our men is a recent idea in this country, and there is lacking that spirit of enthusiasm and interest in their own business, which is characteristic of people who receive a stated wage for stated work, or think of payments for service in terms less than years and months.

At every meeting of chemists some time should be devoted to considerations of the proper procedure to be taken at the next annual meeting. Have ideas and get them in shape. Be positive, enthusiastic and willing to work out the details of whatever plans may be thought best by the majority.

In this number we are publishing an address by Mr. H. Roast of Montreal, secretary of the Chemists' Committee on Organization. This should be read with interest by every chemist.

There are many valuable ways in which a united body of chemists might assert their influence at the present time, and this opportunity should be grasped with sure hands at the next convention of Canadian Chemists.

THE TREATMENT OF WASTE TANNERY LIQUORS.

No general formula, applicable in all cases, will embrace tannery wastes or their treatment, but, for purposes of discussion, the liquors may be roughly classified as follows:

1.—Spent water from the steeping or washing of hides prior to decapillation.

2.—Waste liquor from the lime pit and washwater from rinsing following de-hairing.

3.—Spent liquors from the tan pit.

4.—Miscellaneous washwaters, salting liquors, dye wastes, etc.

The discharges of the first class are heavily charged with blood, excrement, particles of tissue, etc.

Those of the second class contain spent lime, hair, tissue, etc.

Liquors of the third class contain salts of lime and tannic acid, putrid extracts from the skin, etc.

The bulk of the objectionable matters are usually found in the discharges just enumerated, but the fourth class, though less offensive, is of a highly undesirable character.

Whether it is more desirable to treat the pit liquors separately depends, in any given case, upon their relative volume and concentration. Where the washwaters are of sufficient quantity and of such a character as to afford satisfactory diluttion, treatment of the combined wastes is preferable.

If all the waste liquors are united for treatment, and the volume of the discharge is great enough to warrant it, it is often desirable to pass the liquors through a mechanical fine mesh screen before subjecting them to further clarification in tanks or roughing filters. The screen will remove much of the heavier matters, relieve the load on subsequent devices and greatly lessen the volume of sludge to be handled.

Further treatment must usually follow screening to take care of the colloidal and suspended matter passing through the screen. Ordinarily, this may be provided for in some form of settling tank. Where volume of liquor is considerable, a roughing filter is used, consisting of a shallow bed of coarse straining material through which the liquor passes at comparatively high rates. A primary coarse strainer may be followed by one or more containing finer material, and the degree of clarification is on an average about fifty per cent. more than that provided by ordinary settling tanks.—By Waldo S. Coulter, in Hide and Leather Journal.

The Clay Deposits of Northern Ontario

By J. Keele

THE stoneless clays found at or near the surface in northern Ontario, are nearly all composed of sediments deposited in glacial lakes which were formerly of large dimensions. Lake Abitibi may be taken as an example of the shrunken remnant of a once extensive lake of this character. The distribution of the clays are governed, therefore, by the extent of territory covered by these lakes and the height to which the water encroached on the land surface, and to the subsequent drainage which extinguished or partly extinguished these lakes and made their sediments available as land surface. Considering the land area of northern Ontario as a whole, the areas underlain by stoneless clay sediments are very small and widely scattered.

The stoneless glacial clays in northern Ontario differ from the marine clays in the Ottawa and St. Lawrence valley in being almost always stratified in thin layers and frequently interlaminated with layers or films of silt instead of being massive and uniform in texture like the latter. They are similar in regard to their uses, being low grade, easily fusible clays, suitable only for the manufacture of common brick and field drain tile, and not for vitrified wares.

Clays Along the Temiskaming and Northern Ontario Railway Line.

The rugged region between North Bay and North Cobalt, traversed by the Temiskaming and Northern Ontario railway, appears to be absolutely devoid of clay of any description, even boulder clay. The unconsolidated surface materials are sand, gravel, and boulder drift. At North Cobalt stratified glacial clays begin and continue in an almost unbroken stretch to Mindoka station, a distance of 50 miles. Between Mindoka and Bourkes stations the railway traverses the upland containing the watershed between the Hudson Bay and Ottawa waters, in which clays are absent or confined to the bottom of the narrow valleys between steep rock ridges. Between Bourkes and Porquis, a distance of 40 miles, there are extensive patches of lands underlain by lake clays. Between Porquis and Cochrane there are no clays, the superficial deposits being either sand or gravel. Samples collected at the following points will serve to illustrate the character of these materials in general.

Haileybury.—The clay bank, which is about 30 feet high, consists of alternating clay and silt layers, the clay layers are brown in color and one-half inch to one inch thick, and the silt layers vary from half an inch, to mere films, the silt bands are ash-colored, and are wider toward the top of the bank. Numerous concretions of hard limy clay occur in the upper 6 feet, but below this the clay is free from them. The lime content of this deposit is rather large, the silt layers being very limy. The bank is weathered to a brownish colour to a depth of 10 to 12 feet below the surface, but beneath the weathered zone the color is dark grey. The sample taken for testing included an average of 20 feet from the surface, the results of the test being given in the table.

In working the clay for brickmaking about 25 per cent. of rock tailings from the mines at Cobalt is added instead of sand. This mixture is passed through two pug mills, with a pair of rolls set between, and sent to a soft-mud machine for moulding. A stiff-mud machine was formerly used, but was found to be unsuitable, as too much loss occurred from cracked brick made by the process. It is found that the best results are obtained by moulding the clay as wet as possible in the soft-mud machine; but even then a considerable number of checked brick occur in every burning. The loss from checking could probably be still further reduced by the addition of a small amount of common salt to the wet clay. The bricks after moulding are sent to a dryer heated with steam pipes, and some of the checking appears to occur here, especially in the lower part of the dryer cars nearest the steam pipes.

The burning is done in up-draft scove kilns, two of which are supplied with permanent side walls, the fuel used being wood. There is some loss in the fire arches from cracked and slagged brick, and others show fire checks above the arches. The best brick are hard, and ring when struck together, the color is a good red, which is mostly imparted by the coating of moulding sand, as the body is somewhat pale or salmon color.

The use of Cobalt tailings for mixing with the clay should be noted. This is a crushed diabase and slate conglomerate and is the refuse from the mills of the mines around Cobalt. This material stands a little more heat than the clay without fusing, but it undergoes incipient vitrification along with the clay at the temperature of burning the brick, consequently it is sintered in the body and becomes part of it. An ordinary sand which is mostly composed of quartz grains is inert at this temperature and consequently if much is used becomes a source of weakness, and makes the burned brick punky. It would be useless to add it even in small quantities to a silty clay such as the above. Rock tailings of different grades of fineness can be obtained from the waste piles at the mines. The finest of all remains suspended in water for some time without settling. Experiment made with this material proved that it could be used as a dark brown glaze such as that produced by the Albany slip clay which is used so much for glazing stoneware goods. It matures between cone 7 and 9, and is a richer color than the Albany slip.

Heaslip.—According to borings made for water at the railway station at Heaslip, the depth of clay in the clay plain at this point was 110 feet. In some places low ridges of rock or boulder clay protrude through this plain, so that the depth to which stoneless clay extends in the district is very variable. There appears, however, to be an abundance of stratified stoneless clay available at many points. The sample for testing was taken on the bank of a creek alongside the wagon road opposite 133 mile post on the railway, about 1½ miles south of Heaslip station. The clay here is brownish on top, grading to yellow to blue-grey below. It is well stratified, and contains films of silt between the clay layers. An average sample of 15 feet in thickness from the surface downward, a separate sample including only the bottom blue clay, and a small sample of the top brown clay, were taken at this point.

The clay at Heaslip does not contain such a lare proportion of silt as that at Haileybury, it is consequently rather more plastic, and has the same drying shrinkage. Its drying qualities are not good, so that it must be dried slowly to avoid cracking. The working qualities of the average sample (No. 345) are fair, so that it can probably be used for making field drain tile except in the larger sizes. In burns to light red porous, but strong body at the lower

temperatures, but turns lighter if burned higher. This clay would be suitable for making common brick, preferably by the soft-mud process. A moulding sand which burns to a good red color should be selected, as the body color is not good. About 25 per cent. of sand should be added to this clay to improve the drying qualities and lower the shrinkages.

The bottom clay No. 346a is more silty than the average sample, consequently its working qualities are not so good, and it carries a higher percentage of lime. The higher content of lime causes it to burn to a buff color and a more porous body. This material would make good buff building brick if used alone. It would not need the addition of sand as the shrinkages are low.

The top clay to a depth of about 2 feet below the surface is the most plastic and best portion of the deposit. It has good working qualities, burns to a strong red color, and good dense hard body.

A layer of ash-colored silt overlies the surface clay in the vicinity of Heaslip. It varies in thickness from a thin veneer to nearly 3 feet thick, and grades into a fine-grained sand or sandy loam in places. This material has a low plasticity, and can be moulded by hand. It burns to a pale red, very porous body, at low temperature, and in this form can be used for scouring purposes like bath brick. It gives better results as a polisher than most of the commercial bath brick on the market.

Matheson.—The village of Matheson and the immediate vicinity is underlain by stratified stoneless clay. Records of borings of two wells near the railway station showed 60 feet of clay, anotner showed 46 feet, and a fourth only 16 feet. Bed-rock crops out under the clay in the bank of Black River in the village. The clay rises in terraces to a height of 60 feet above the railway track a short distance south of the village. This clay is generally brownish in color in the upper portion, but is bluish-grey below the weathered zone, and appears to be absolutely free from pebbles, concretions or coarse grit. There is a layer of light grey silt scarcely a foot thick on the surface.

The sample of clay for testing was taken about a quarter of a mile east of the station, near the railway line, in a depression, where about 8 or 9 feet in depth were exposed. This clay, Lab. No. 344, when mixed with water to the proper consistency, has good working qualities, being very smooth and plastic. Its drying qualities are not good, so that it must be dried slowly after moulding to avoid cracking, and there is also too much shrinkage in drying.

The clay burns to a salmon-colored porous body at the lower temperatures, but owing to its high lime content turns to buff when fully fired.

The addition of 25 per cent. of sand improves the drying qualities and reduces the drying shrinkage by 2 per cent. With this amount of sand a very fair buff building brick can be produced, and it could also be used for making field drain tile. There is a certain amount of sand available in the high ridge near the village, but as the ridge carries a good deal of coarse and fine gravel mixed with the sand, it can only be obtained by screening.

The rock tailings from the mines at Porcupine added to this clay would make a better material for the purpose than sand, but the distance to the mines is too great to make this economically possible.

Porquis Junction.—About half a mile south of the station at Porquis Junction the railway cutting exposes a section consisting of 5 feet of brownish weathered and crumbling clay, underlain by 6 feet of banded brown and grey clay, with silt films, below which is 2 feet of dark grey stratified clay, the whole being from stones or concretions. This clay is similar to the deposit at Matheson in its qualities, having the defective drying qualities and high shrinkages which are characteristic of most of this area. A fairly good common brick, however, could be made from it by the soft-mud process, using about one part sand to three parts clay. The colors obtained are salmon to buff, depending on the heat of burning. Sand for mixing is not available in the vicinity of the deposit, but can be obtained about a mile or so to the north.

Timmins.—A sample of clay from this vicinity was shipped to the laboratory for examination, accompanied by a sample of sand. The clay was similar to that described from Porquis Junction, except that the sample appeared to be taken only from the upper weathered portion, and consequently, was rather more plastic and sticky when wet than if some of the bottom silty clay had been included.

Mixtures were made of three parts clay to one of sand, and two parts clay to one of sand. Both mixtures worked fairly well in the machine, the hollow tile coming perfect through a die without lubrication. The brick tore a little at the corners when passing out of the die.

In the drying tests the bricks made of three to one mixture cracked in the dryers at 120 degrees Fahr. Bricks kept at room temperature indoors for two days, and then exposed to wind and sun, were found to be checked shortly after exposing.

The samples of 4-inch drain tile and brick made by hand from the same mixture did not crack under the above conditions of drying.

Bricks made by hand from a mixture of two parts clay to one part sand, set to dry outdoors exposed to sun and wind, immediately after moulding cracked inside of one hour. When protected from the sun, but exposed to the wind, cracking ensued within two hours after exposure.

Samples of soft-mud hand-made brick, of the three to one mixture, kept continually indoors at room temperature, dried in 7 days, and stiff-mud brick made on the machine required 9 days to dry.

The drying qualities of this clay are decidedly poor, and much care and patience would have to be exercised at this stage of the manufacture in order to avoid excessive losses. A clay of this type is known as a tender clay by brickmakers, and the deposits at South Porcupine, Porquis and Matheson have the same defect.

The sand which was sent with this clay was rather fine-grained, 85 per cent. of it passing through the 100-mesh screen. It is suitable for a moulding sand for use in making soft-mud brick, but a coarser grade of sand would be more suitable for mixing. The coarse rock tailings from the gold mines in this district would give better results than sand, especially in the quality of the burned ware.

National Transcontinental Railway.

Cochrane to Hearst.—The region traversed by this railway is a slightly undulating boulder clay plain, still covered with much forest and swamp growth. Occasional shallow cuttings along the line show the generally stony character of the clay which unfits it for the most part for purposes of brick and tile making. The principal areas of stoneless clay appear to occur in the depressions through which the

larger streams of the region flow. At many other points the surface clays contain so few pebbles or stones that they may be used for brickmaking, although the deposits are not deep as a rule and pebbles are invariably encountered at depth. Such clays may not be more than 1 to 3 feet deep. In this respect the deposits are of a similar character to those found in southwestern Ontario, particularly in Essex county, where the clay worked for brick and tile is a surface layer of only 18 inches, lying upon stony clay. Most of the clays found in these stoneless patches contain a high percentage of lime and are buff burning, showing that the leaching processes of weathering which in time remove the excess of lime did not penetrate very deeply in this region. Some of these clays found in Brower and Lamarche townships will make as good buff stock brick and drain tile as any produced in the older parts of the Province.

Algoma, Thunder Bay, and Rainy River Districts.

Several large deposits of glacial clay suitable for brick and tile manufacture are found at Sault Ste Marie, Fort William, and other localities in these districts. A full report of these materials is in preparation.

A sample of this clay was secured from Mr. W. Tees Curran, of Montreal—one of the owners of the deposit. This sample, Lab. No. 620, was of the light grey or white beds, with a few pieces showing pink color. In a washing test, 70 per cent. passes through a 200-mesh screen, the material coarser than this being little worn and angular quartz grains. The dry clay requires 27 per cent. of water to bring it to the best working consistency for moulding. The plasticity and working qualities are good, and the shrinkage on drying is about 5 per cent.

This clay burns white up to cone 3, but when burned to cone 9 (1310 deg. C.) the color darkens, but the body is still porous. The softening point is about 28 (1690 deg. C.) which classes it as a fireclay. The chemical analyses of this clay shows it to contain iron and titanium in appreciable amounts, which are responsible for the darker color of the clay at high temperatures, which unfits it for use in white pottery ware, but there are probably some beds of white clay in the deposit free from this defect. The buff and pink clays contain still more iron and are not refractory enough to be classed as fireclay.

SUMMARY TABLE OF PHYSICAL TESTS OF SURFACE CLAYS IN NORTHERN ONTARIO.

Locality	Lab. No.	Water required for Mixing	Drying Shrinkage.	Cone 010.		Cone 06.		Cone 03.		Remarks.
				%F.S.	Absorp.	%F.S.	Absorp.	%F.S.	Absorp.	
North Bay, Nipissing	242	25	6	0	18	0	15	3	5	Very silty clay.
Sturgeon River, Nipissing..	244	25	6	0	21	0	20	5	9	Good working qualities.
Haileybury, Timiskaming ..	348	27	8	0	20	1	20	1-3	16	Average sample of deposit.
Haileybury, Timiskaming ..	348	25	6	0	19	0	18	1	17	With 20% mine tailings.
Heaslip, Timiskaming	345	29	8	0	19	0	19	1	16	Average at deposit.
Heaslip, Timiskaming	346	20	6	0	13	..	..	2	9	Top clay, burns red.
Heaslip, Timiskaming	346a	..	6	0	21	0	21	1	20	Bottom clay, burns buff.
Matheson, Timiskaming ...	344	27	9	0	18	1	18	3	18	Buff burning.
Porquis, Timiskaming	343	30	8	0	21	1	21	1-3	18	Fire checked.
Hearst, Algoma	342	..	7	0	29	1	20	1-3	17	Contain lime pebbles.
Steelton, Algoma	334	26	7	0	16	0-5	17	1-7	13	Contain lime pebbles.
Steelton, Algoma	335	22	7	0	12	1	10	2	8	Elliots brickyard.
Rydal Bank, Algoma	587	..	9	0	17	0	17	8	0	Top clay.
Rydal Bank, Algoma	587a	..	5	0	15	0	15	6	3	Bottom clay.
Sudbury, Sudbury	245	19	4	0	15	0	14	0	10	Very silty clay.
Fort William, Thunder Bay	336	27	7	0	16	0	15	1	14	Alseps brickyard.
Port Arthur, Thunder Bay.	339	..	3	0	16	0	15	1	14	McIntyre River.
Rosslyn, Thunder Bay	340	..	7	0	20	0-5	19	1	16	Superior Brick Co.
Finmark, Thunder Bay	341	30	8	0	14	0	13	1	13	With 25% sand.
Mine Centre, Rainy River..	611	34	8	1	22	1	21	11	0	Bottom clay.
Mine Centre, Rainy River..	612	31	10	..	..	6	2	..	..	Top clay, fire checked.
Fort Francis, Rainy River..	276	23	7	0	18	0	15	0	14	Not overfired at cone 1.

Equivalent approximate temperatures—Cone 010 1,742 Degrees F. 950 Degrees C.
Cone 06 1,886 Degrees F. 1,030 Degrees C.
Cone 03 1,944 Degrees F. 1,090 Degrees C.

.... Fire Clays on Missinaibi and Mattagami Rivers. ....

Missinaibi River.—The occurrence of deposits of fire and pottery clays on the Missinaibi River in Northern Ontario, have long been known, and were described by J. M. Bell in the annual report of the Ontario Bureau of Mines for 1904. These deposits outcrop on the bank about 8 miles above the mouth of the Wabiskagami River, and are also exposed on the banks of the latter river. According to borings made by the holder of the property in 1913 the greatest thickness of clay was said to be 74 feet, measured from the river level to the top of highest portion of the bank where clay was found. The deposit consists of beds of white, pink, buff, and grey plastic clays, with sandy clay, or white sand layers.

A mixture of the clays could probably be used for making pottery of the stoneware type.

Mattagami.—Fireclay was first discovered on the Mattagami River during the summer of 1917 by C. M. McCarthy, of Elk Lake, who reports the occurrence in the river banks, a short distance below the foot of the long portage; and sent a sample to the Mines Branch laboratory for examination. This clay, Lab. No. 618, is nearly white in color when dry. When washed and passed through a 200-mesh screen, only 10 per cent. remains behind, composed of small quartz grains. It requires 23 per cent. of water to bring it to the best wet condition for moulding; and is then very plastic and smooth, with excellent working qualities. It dries readily with a drying shrinkage of 6 per cent. The clay burns

white up to cone 3, but some dark specks show in the body when burned to cone 9. At the latter temperature it is still porous, the absorption being 9 per cent. This clay is still intact when raised to the softening temperature of cone 31 (1,750 deg. C.) in a carbon resistance electric kiln, and softens at cone 33, so that it is a number one fireclay.

When submitted to a washing and settling process, about 75 per cent. of fine pottery clay can be obtained from the crude material. The washed clay was dried and made up into a standard porcelain body of the following proportions:

Washed Mattagami clay	50 per cent.
Ground feldspar	20 per cent.
Ground quartz	30 per cent.

This mixture was made into a slip, and cast in the form of small cups. These were biscuited in a commercial china kiln at cone 10, then glazed and re-fired at cone 4. The pieces turned out had a beautiful ivory tone, but as the china trade demands whiteness, the clay would require the addition of a little cobalt stain in order to meet the requirements of that industry.

This clay would probably be suitable for the manufacture of crucibles used in the metal melting processes.

The following analysis show the chemical composition of these clays:

	I	II
Silica	58.90	53.10
Alumina	26.63	31.92
Ferric oxide	1.40	1.52
Titanic oxide	1.25	Not determined
Lime	0.56	0.51
Magnesia	0.16	Trace
Manganese	0.01	Not determined
Potash	0.31	0.28
Soda	0.42	0.54
Water	10.30	12.35
	99.94	100.22

I. Missinaibi clay, No. 620. Analysis by M. F. Connor, Mines Branch, Ottawa.

II. Mattagami clay, No. 618. Analysis by W. K. McNeill, Ontario Bureau of Mines, Toronto.

High grade clays of this description have not been found so far in any other place in Ontario, although they have been diligently sought for. It is unfortunate that the above deposits are located in such a remote region, without transportation facilities, and 50 miles from the nearest point on the National Transcontinental Railway. It is possible that in further prospecting other valuable deposits of this kind may be found nearer the railway line.

(From Ceramics Laboratory, Mines Branch, Ottawa. Summary Report, 1918.)

STEEL AND PAPER BELTING.

During the war, Germany made transmission belting out of steel and paper. Steel belts have been in more or less common use for a number of years. The use of paper, however, for transmitting power, is at first sight, more or less of a startling innovation. Several different processes are used in making the belts. Some are made of plaited or knitted paper yarn, and thus have no transverse threads, making the edges very strong and eliminating fraying. Other belts are woven or knitted in tube form, and afterwards flattened out and stitched together.

GRASSES AS PAPER-MAKING MATERIALS.

Certain tropical grasses are being examined, in the hope that substitutes for wood pulp may be found. This work has been carried on for some time, and now much evidence is available, which would point to a greater utilization of such materials at some future date. Both the lalang grasses of the Malay States and the bamboo grass of Northern Australia have recently been reported upon by the Imperial Institute, London. The yield from lalang grass, under commercial treatment with soda, was from 40 to 46 per cent. of dry pulp. This, being long-fibred, has good felting qualities and produces a strong opaque paper. The bamboo grass did not yield as much pulp, and the quality was poorer. For many purposes, however, this grass is quite suitable for paper making. Spanish esparto grass makes perhaps the best pulp and paper of any of the suitable grasses.

PRUSSIC ACID IN BEANS.

One of the drawbacks in importing certain beans from Asiatic countries has been the variable and sometimes dangerous quantities of prussic acid which they have been found to contain. The British authorities are studying this problem, and are gradually gathering data. A very complete account of experimental work in growing these varieties and others is given in Bulletin No. 3 of the Imperial Institute, 1918. Madagascar beans, when grown in Burma on two types of clays, did not show much decrease in prussic acid; the average amount present being about 0.0002 per cent. The second crop in the same season and in the same place showed smaller quantities of the acid. A white variety of pe-nge bean, introduced from the United States, contained, in the second year, 0.005 per cent. prussic acid. The native white Burma beans ran up from 0.016 to 0.03 per cent. Haricot and Tepary beans gave negative tests for prussic acid.

ELECTRIC GENERATION AND DISTRIBUTION IN CANADA.

Commission of Conservation, Ottawa.

A work, the publication of which would alone justify the creation of the Commission of Conservation, under whose auspices it has been compiled, has just been issued at Ottawa on "Electric Generation and Distribution in Canada." The compiler is Leo. G. Denis, hydro-electric engineer for the Commission. In the 296 pages of the report details are given on a uniform plan of all the water powers now utilized in each province, showing their cost, volume of power, distance transmitted, the hydraulic and electric equipment, the rates charged, whether owned by private company or municipality or other public body, and to what uses the power is applied. There are many views, plans and maps, and one section, occupying about fifty pages, contains a tabulated analysis of the reports, giving, in condensed form, the horse power of the prime movers (whether water power, steam turbine, steam engine, gas engine, oil or gasoline), the voltage, current, details of transmission lines, consumption and rates, etc. The work will prove of great service as a reference book on the water powers of Canada and if, as is now often said, the scientific and industrial progress of a country may be measured by its hydro-electric developments, this country is shown to be already standing in the front rank. That it will advance still further is as certain as that the rivers flow to the lakes and to the sea.

The Microscopical Analysis of Textiles*

A Very Complete Summary of the Chief Microscopical Characteristics of a Large Number of Materials Used in the Textile Industries

By F. Pugh

THE microscopical analysis of textiles opens up a wide field for study and research, especially when we couple it with a brief touch of history and peculiar characteristics of the various fibres.

Wool is one of the oldest, if not the oldest, fibres used by man for making clothing. Ancient historical records show that spinning and weaving were known to the Assyrians, Babylonians, Persians, Egyptians, Hebrews, Hindus and Chinese at a very early date.

There is no line of demarcation between wool and hair. Fine, soft **Merino** merges into Cross Bred, which merges into English and Lustre wool; they merge into Alpaca and Mohair.

Shrinkage in Weight of Wool in Scouring.

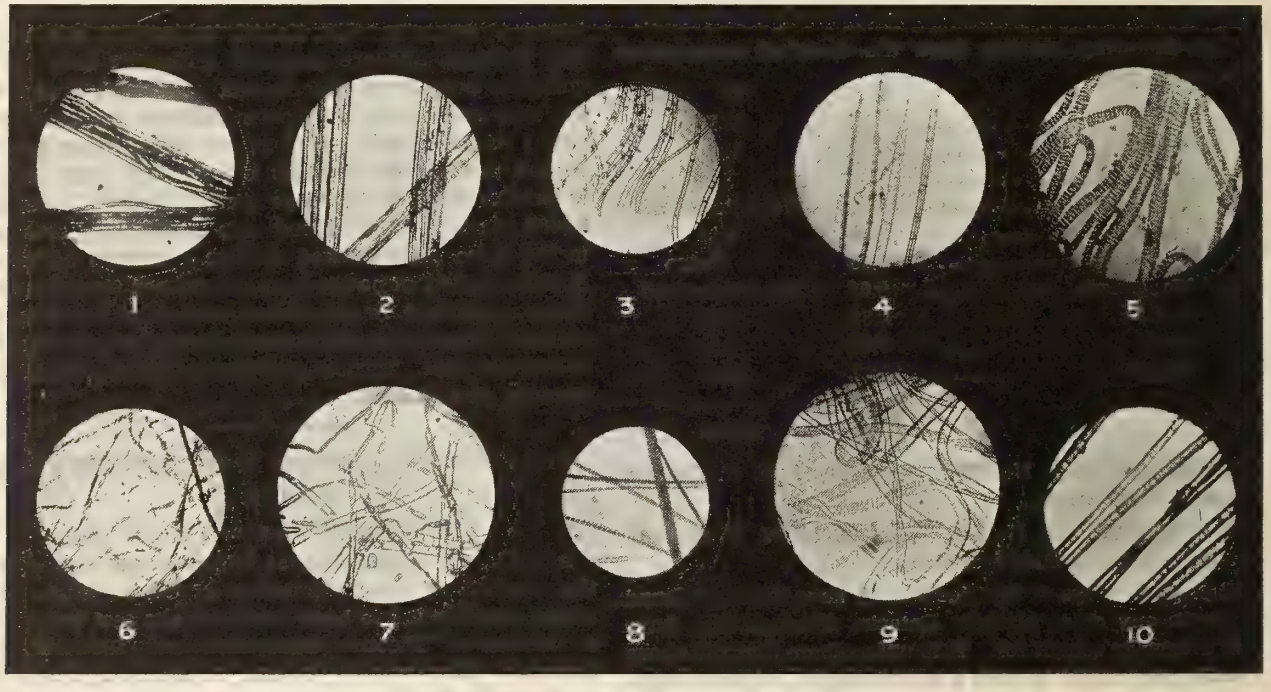
Wool shrinks 25 to 80 per cent., due to sand, dust, dirt, burrs, seeds, oil, paint from branding, etc.

Leicester and Lincoln are coarser and have about 3 to 5 waves to the inch and 1,800 scales to the inch and diameter 16 & 17 / 10,000.

Human Hair is about 33 / 10,000.

Wool, when burnt, largely resolves itself into ammonia gas and carbon beads, whereas cotton flashes and does not smoulder or leave beads. Wool is round and has scales. Cotton is flatter and twisted. See **Wool and Cotton.**

Medullary Cells or narrow or pith of wool fibre are composed of finely granular masses, airs and in colored hairs of pigment granules. Wool of many animals has no medulla. Beard hairs, as a rule, have a medulla. The function of the medulla is to provide the living fibre with an inner canal for the flow of juices. It also makes it porous for absorbing solutions, dyestuffs, different salts, etc., so is an important feature in mordanting, dyeing, bleaching, etc.



1 Reeled Silk 2 Artificial Silk from Cotton 3 Linen 4 Ramie 5 Wool (Merino) 6 Sea Island Cotton 7 Kapok 8 Rabbit 9 Wool and Cotton 10 Angora Goat

Pounds of Wool to Pounds of Cloth.

It takes an average of 3.73 lbs. of grease wool to 1 lb. cloth. Wool shrinking is due to moisture and pressure aided by alkalis or acids. The capacity of felting or fulling being due to the combination of fibres, but boiling in alkali will invariably shrink them. Wool has scales which give strength and lustre. The greater number of scales, the more wavy it is; the finer the quality it is.

Finest Merino frequently has single scale, surrounding the entire circumference, about 2,800 to the inch, and about 24 to 30 waves to the inch and diameter 3 / 10,000 to 5 / 10,000 inch.

South Down is a medium quality and has 2, 3 or more scales, and about 13 to 18 waves to the inch.

The **Epidermal Layer** of scales is rather impervious to solution and only admits in the joints of the scales. If medulla is imperfectly developed, through disease or other causes, poor feeding, etc., it will not absorb dyes. Such fibres are known as kemps, and if used will give a streaky appearance. Cortical cells are the true fibrous portions of the fibre, consist of elongated cells and give strength and elasticity. Long, droughty seasons produce shorter fibres; slight rainfall produces finer fibre; greater rainfall produces coarser fibre. Sheep drinking water in alkali dis-

tricts has a tendency to take the life out of wool and weaken the staple.

Worsted is the wool fibres straightened out by combing and laid parallel.

Woollen is made from short fibres and are not parallel and makes a softer cloth, as it felts and gives a more fuzzy finish.

Mohair is made from Angora goat and is a coarse, very heavy fibre, and very lustrous.

Goat hairs have broad medulla, but the beard hair of some sheep have a similar medulla, but these can be distinguished by mounting in potash and gently warmed, when they show round cells in sheep and elongated cells in goat hairs.

Angora Wool is from the Angora rabbit, and is very fine and silky and comes from the Angora district, 113 miles south-east of Constantinople, where the climate conditions are such as to produce this silkiness. Angora animals taken to other parts of the world lose this silkiness to a large degree, usually about one-third.

True Alpaca is obtained from the cultivated South American goat, native of the Andes Mountains.

Cashmere is the long, silky wool of the Cashmere goat, native of Northern India. There is a fine brownish wool at the root, which is the fine Cashmere, noted for its softness, fineness and beauty.

Camel Hair has two grades—the under hair is very fine and soft. The beard hair has a well-defined medulla.

Cow Hair is used largely in coarse carpet yarns, blankets and cheap, felted goods, also fur fabric cloths. Cell spores are filled with air.

Horse Hair. Medulla consists of one or two rows of narrow, leaf-shaped cells. **Vegetable Horse Hair** is fibrous and has branches.

House Cat Hairs have a good lustre. Medullary canal contains a single series of regular cells.

Rabbit Hair. Medullary canal is filled with several series of cells. Scales fit into each other. Beard hairs are broader, with 2—4 and up to 8 rows of cells.

Shoddy is the term used for re-claimed wool. Microscopically it offers a characteristic appearance sufficient to distinguish it from new wool, generally showing other fibres, such as silk, linen, cotton, etc.; also the different colors of wool fibre and different diameter of fibres, fringed elbows and fringed ends, due to the fibre being broken in re-working. If shoddy were prohibited, we would have to pay more than double for pure wool. In reality, a pair of knee breeches per person would be about the annual allotment. Pure wool frequently shows the presence of vegetable matter such as burrs, bristly and barbed seed, etc.

Linen.

Linen dates from the earliest period of human history. Egyptians made the finest linens, even exceeding in fineness those made by the most improved mechanical inventions of to-day. One piece of mummy cloth has as many as 540 warp and 350 weft threads to the inch. Fine linen to-day runs 104 to the warp and 84 to the weft.

Phoenicians who inhabited lands bordering the Red Sea and the Persian gulf, were a wandering people and were also adept linen workers. Ireland is said to have been colonized by them. Hence the Irish linen industry. The end of the 18th Century saw the inventing of:

The spinning frame by Arkwright.

The spinning jenny by Hargrave.

The spinning mule by Crompton, for spinning cotton, gave a serious blow to linen. The household linen industries shrank and whole villages disappeared, and the linen manufacturer took refuge in special localities, as the demand for fine linens was supplied by cottons. The finest linen in latter days come from Courtral, Belgium, and is retted in crates sunk in the river Lys, which is sluggish.

Prior to 1914, the Continent of Europe raised about 5,700,000 lbs. Ireland often imported from Russia and Belgium three and four times as much as they grew. **Bleaching** forms an important part of the industry, and prior to 1800, it was done by nature, by exposing it five or six months to air, sun and moisture. Artificial means are now largely used—**Chlorine**—and bleaching is done in about five weeks' time. A professional bleacher must know the laws of chemistry, in order to hasten the bleaching period without injury. Linen does not clog the pores, but admits of free exhalation. It has joints resembling the bamboo, which is a means of identifying it. The preparation of the linen fibre, until a few years ago, was done on the same lines as was used 3,000 years ago. Retting was done in stagnant water—ditches, dams, etc., being used. A new process is now being used. A flax-pulling machine is used, instead of pulling by hand. Deseeding is being done in an improved way and is capable of affecting a saving of 40,000 tons of stock food annually in Ireland, which was previously wasted. The retting is done under cover and machinery is extensively used, eliminating the human element, bidding fair to revive flax growing in Ireland on a very profitable and more certain basis.

Silk.

A product of the worm from the moth (Bombax Mori). Over three million people depend on the silk-worm industry for their living. Silk is the richest, strongest, most lustrous and most valuable fabric used by man. Mistress Lee-ling-chie, wife of Emperor Huang-ti, of China, is reported to have first tended and fed the worms, unravelled the cocoons and spun and weaved the first silk cloth. The Chinese guarded the secret of the art for many centuries. Early in the 3rd century, knowledge of the silk industry reached Japan, and a short time later a Chinese princess carried eggs and mulberry seeds to India concealed in her head dress. The Roman Government, under Justitian, in the 6th centry, A.D., about 550, induced two Persian monks who had lived in China, to return to China. They travelled by foot with several thousand eggs secreted in their hollow staffs of bamboo and returned to Rome. A moth lays from 200 to 500 eggs, 34,000 weigh one ounce. The mature worm exudes from two glands simultaneously a line of thread about 400 yards, sometimes 800 to 1,200 yards long, which it winds around itself. The cocoons are dried for a few days, then immersed in boiling water. The different processes are gathering the cocoons, reeling off the silk, throwing, scouring, dyeing and weaving. Silk absorbs dyes and weighting materials very readily. Up to 1857, it could be weighted up to its own weight with dyes and gum, but an accidental discovery showed that tin salts and nitrate of iron enables dyers to add 40 ounces to the pound of scoured silk; 120 ounces to samples of gummed silks and 150 ounces to the pound of spun silks. Weighting reduces strength, elasticity and cohesion. **Pure silk** will retain its lustre and strength for many years.

Silk appears to be a continuous filament devoid of structure. The surface shows faint striations, and can be

disintegrated into small filaments, indicating that it is made up of minute fibrils. It is much stronger dry than when wet, losing about 12 to 45 per cent.

Artificial silk loses about 33 to 80 per cent. Tensile strength of true silk is about 64,000 lbs. to the square inch, or nearly one-third that of the best steel. It is very elastic, stretching 15 to 20 per cent. It is hydroscopic, absorbing 30 per cent. moisture, and still appearing dry. Microscope shows cultivated silk usually in double fibres.

Tussah wild silk is wider, single fibres. Particles of the gum of the cocoon adhere to the fibre, which is a means of distinguishing it from **artificial silk.**

Cotton.

The cotton plant is a perennial, but is grown as an annual to insure bigger production of fibre. Cotton plants have been grown from time immemorial, some say 3,000 years. The United States now produces two-thirds of the world's supply. Cotton, being a twisted fibre, spins very fine.

Sea Island is the finest cotton and has all long hairs.

Egyptian cotton (about 80 per cent. of what is not raised in the United States) has characteristics which make it desirable, such as fineness, strength, elasticity and great natural twist, which makes fine yarns suitable for better quality hosiery, etc. It also mercerizes well.

Upland cotton has both long and short hairs.

Red Peruvian cotton is dark in color and coarser in fibre than other cottons, and is used largely as a substitute for wool, on account of being more rounded and not so twisted.

India cottons are poorest, due to poor cultivation.

Cotton can be worked with greater rapidity than linen.

Mercerized cotton is made by treating with concentrated caustic alkalies (soda) and giving it a tension to prevent contractions. Celulose is changed to celulose hydrate. Mercerizing increases the strength about 48 per cent. John Mercer patented the process in 1850.

Humidity test shows that cotton increases in tensile strength, and is, therefore, best spun when moist.

Increase of humidity of 45 to 85 per cent. gives increased strength 16.23.

This accounts for Manchester being such a great cotton-spinning centre, as it is said to rain there about every day.

The breaking strain of cotton. The individual fibre is altered when spun into yarn or thread; single yarns give only about 20 per cent. of the calculated strength of individual fibres.

Hemp.

A valuable annual plant, with stems 4—6 feet, possessing properties similar to flax and jute. Hemp seed is used as food for canary birds; also yields a large percentage of oil used for soap, varnishes and for burning.

Jute.

An annual plant, growing 12 to 14 feet high, mainly cultivated in Bengal, India.

Kapok.

Kapok, sometimes called sil kcotton, is borne on the interior of the pod, but not attached to the seed as cotton. It is used for stuffing pillows, mattresses, etc., but is too short a fibre to be spun.

Coir.

Coir is made from the husks of the cocoanut. It is used in making cordage. Principally used for maritime purposes, also matting, etc.

Asbestos.

This is among the finest fibres in diameter, and is fireproof. Used in the making of coarse cloths for special purposes.

Ramie.

Ramie, rhea or China grass, is not a grass, but more of a shrub, which grows from 3 to 8 feet high. It was known in China at a very early period and is said to have been used in Egypt several thousand years ago with flax in the preparing of mummy cloth. The fibre is strong and durable and of all commercial fibres is least affected by moisture. It has the greatest tensile strength of all vegetable fibres. Microscopically, it shows transverse cracks, but not so distant as linen. It has a high lustre and a silky appearance and great length of fibre—10—15 centimetres, often 25 to 40. The great difficulty is in degumming it, as it cannot be retted, like flax, on account of the gum not being soluble in water. The gums are essentially composed of pectose, cutose and vasculose, while the fibre itself is composed of fibrose, celulose and its deriviatives. The degumming, therefore, is to dissolve and wash out the gums without attacking the celulose. A fortune awaits the genius who can discover economical methods of degumming this fibre.

Olona.

Olona from Hawaii is claimed to be the strongest fibre. It is exceedingly durable, as fish nets used in salt water 100 years old are still in use.

Comparisons of Heat-retaining Values of All-wool and All-cotton Blankets.

It is possible to make a 3½-lb. cotton blanket which will have 46 per cent. greater heat-retaining value than a 5-lb. all-wool blanket. It altogether depends on the construction of the blanket, rather than on the fibre itself. An all-wool, 5-lb., thick, loosely-woven blanket would be warmer than a 6-lb. thinner and more densely-woven all-wool. A blanket constructed of loosely-woven cotton will be warmer than one tightly-woven all wool, for indoor use, but for outdoor use, the wool is much more satisfactory, as they do not so readily absorb moisture and become soggy as cotton do.

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*A paper read before the Manitoba Chemical Society, Winnipeg, Dec. 17th, 1918.

PROTECTION FOR CONCRETE CHIMNEYS.

A lining of burned clay, extending the full height of the stack of the chimney, has been used with success to overcome the cracking, leaning, and sometimes collapsing of concrete chimneys. Concrete has always been held to be unsuitable for construction purposes where it is subject to the attack of heat, products of combustion, or undiluted acids. One of the best known structures in which such conditions prevail is the chimney. In the case of those which decayed very soon after being put in operation, the thin walls of the stack permitted a very rapid radiation of the heat. Condensation took place on the inner side of the stack, and the condensate worked its way into the fissures rapidly destroying the texture or the material and attacking the reinforcing steel. There is little difference in the cost of a well constructed concrete stack, with a lining of burned clay extending the full height, against the cost of a radial brick chimney.

WESTERN COAL.

The Second of Three Articles Discussing the General Western Fuel Situation and Government Procedure in this Connection.

By PROF. R. D. MacLAURIN, Saskatoon, Sask.

The economic utilization of fuel is becoming more generally recognized as an important national problem. It is well known that a large percentage of coal is wasted at the mines and also through inefficient methods of combustion in furnaces. Obviously, a logical solution of the problem would be to perfect methods of mining, so as to eliminate waste, and also perfect methods of combustion, so that the complete output of the mine can be completely burned. Whether fuel is in the gaseous, liquid or solid form, it must undergo combustion before heat is obtained, consequently, in considering the fuel problem from a national standpoint, the study of improved methods of combustion cannot be wisely overlooked.

After the appointment of the Honorary Advisory Council for Scientific Research over two years ago, one of the first problems to attract its attention was that of fuel. Since that time the members of the Fuel Committee have spent much time in search of knowledge about fuel. Finally, recommendations were made to the Government for the expenditure of $400,000 for the purpose of erecting a carbonizing and briquetting plant in Saskatchewan. The request was granted, and a Lignite Utilization Board has been appointed for the purpose of carrying out the recommendations.

In the report on the Briquetting of Lignites, written by R. A. Ross, and published by the authority of the Sub-Committee of the Privy Council for Scientific and Industrial Research, there are a number of sweeping statements which should be dispassionately masticated before endeavoring to digest them.

Mr. R. A. Ross states: "For the utilization of these fuels in the most effective way for both domestic and commercial purposes, commercial preparation is necessary. The best immediate returns will be secured by the development of lignite briquetting processes." As Mr. Ross discusses only one method of utilizing lignite, it is difficult to determine how he arrives at the conclusion that *the most* effective way of treating lignite is by carbonizing and briquetting, or that the *best immediate* returns will be secured by the same method. Whether those conclusions are correct or not, Mr. Ross presents no facts in his report from which such conclusions can be deduced, and one would naturally expect evidence in support of these statements when a large expenditure is to be made. The writer is of the opinion that much research will be necessary before such claims for briquetting can be substantiated by facts. Nor can those statements be accepted until a comparison of costs is made between briquetting and the burning of raw, dried, and carbonized lignite. Even after this information is obtained, it is not likely that any one method will adequately meet all the requirements for domestic and commercial purposes, but rather that each variety of lignite (raw, dried, powdered, carbonized and briquettes) will secure a market for which each is best suited.

R. A. Ross: "Throughout the West, and especially in Saskatchewan, the householder must use native lignite and sub-bituminous coals, which present no advantage for domestic purposes other than cheapness." Western coals have been used in power plants, large blocks, and for domestic purposes for many years, for the reason that they were cheaper than using anthracite. This fact has already been established, and with improved methods of combustion in commercial and domestic furnaces, further large reductions can be made in fuel costs.

If cheapness is not an important consideration, why does Mr. Ross claim that large economies will be derived by using briquettes instead of anthracite! The fuel from which the most heat can be extracted for the least money is what is wanted. As soon as methods of handling and burning lignites more efficiently become generally known, the public will not feel disposed to purchase anthracite or a substitute irrespective of cost.

The chief objection which Mr. Ross mentions against the use of raw lignite is, that lignites contain a high percentage of moisture, which renders the raw fuel unsatisfactory for domestic use, both on account of the cost of transporting the water and of its evaporation.

The argument that the cost of transporting water and of its evaporation renders the raw fuel unsatisfactory for domestic use, and therefore the raw fuel should be carbonized and briquetted, is not a sound argument unless it can be shown that it is not profitable to pay freight on the moisture. In order for the above argument to be tenable it must be shown that briquettes will be better and cheaper fuel than raw lignite.

Too much emphasis has been placed on the cost of transporting moisture, and at the same time ignoring the fact that if briquettes are made from lignites with high ash content, that the resulting briquettes will contain quite as much ash as lignite (Estevan) does moisture. There is little choice between paying freight on moisture or ash, except that in using the fuels it is more convenient to evaporate moisture than to carry ashes. It must be borne in mind that lignites with the highest percentage of moisture usually have the lowest content of ash, and as the moisture ceases, the ash increases; consequently, in order to secure briquettes which would have a heating value approximating that of anthracite, lignite must be used which has a low ash content. This limitation of the process should be recognized, as it is a determining factor in its applicability.

Disintegration of lignite has been the chief objection to its general domestic use, but although lignite disintegrates quickly when exposed to weather conditions in the summer time, such is not the case in the fall and winter, or when proper storage facilities are provided. However, this objection may be largely overcome owing to the fact that lignite slack can be burned efficiently in the proper design of domestic furnace, and, as a consequence, the successful marketing and use of lignite for domestic purposes should be greatly increased.

TREATMENT OF PEAT BY PRESSURE.

In the improved Ekenberg process of treating peat as tested at Cheateauneuf, Bretagne, France, the raw material is first compressed to reduce the water from about 90 per cent. to 60 per cent. It is then subjected to the action of superheated steam at 160 degrees C. for 25 minutes, and is afterwards again compressed or at once dried in special chambers, or in the open air. "Turbon," as the product is called, still retains 20 to 25 per cent. of moisture. It yields 61 per cent. of volatile matter, and its calorific value is 10 per cent. higher than that of ordinary peat. It is recommended for direct firing, for gasworks where ammonia can be recovered, and especially for power gas for internal combustion engines. Such processes so far have never been found to be very economical, on account of the colloidal nature of the peat skin.

Annual Meeting of Engineering Profession

FROM February 11th to the 13th Ottawa was the centre of attraction for the engineering profession of Canada.

The Engineering Institute has now behind it a thorough organization, and the results of this good work are very evident.

In their president, Lieut.-Col. R. W. Leonard, M.E.I.C., they have found a leader and a man devoted to the profession and its advancement in Canada. Several able addresses were made and technical papers given during the three-day session. His Excellency the Governor-General spoke at the opening luncheon and on Thursday over 300 were present to hear the Hon. F. B. Carvell. Several technical papers were presented by members. Capt. R. J. Durley, M.E.I.C., chief of division of gauges and standards, Imperial Munitions Board, described the setting of certain standards in engineering practice. Papers were given on the future of aviation, good roads, mean sea-level datum, the Montreal tunnel, railway electrification, and the mining and metallurgy of Cobalt silver ores. All these papers dealt with either recent successful engineering work or problems of general interest which should receive careful study by the government and engineers. The paper delivered by Lieut.-Col. R. W. Leonard was, however, of special merit, as viewed by the metallurgical or chemical engineer. As president of the Coniagas Mines, he is an authority on the mining and treating of Cobalt silver ores. A short review of his paper is given here.

Paper by Lieut.-Col. Leonard on "Cobalt Silver Ores."

In the Porcupine-Cobalt-Sudbury group we have at least two of the most wonderful mineral deposits in the world. In 1918, Sudbury produced copper and nickel to the value of $35,300,000 in matte form. The market value greatly exceeds this when refined products are considered and refining in Canada should develop the production of chemicals and machinery required in the processes. The metal, cobalt, associated with nickel and arsenic, is found with the silver in the Cobalt ores. In the district served by the T. & N. O. Railway are found copper, molybdenite, barite, fire clay, and pottery clay, all in notable commercial deposits. Wood, water power, and peat are present to assist in development. In a camp four miles square at Cobalt, 12½ per cent. of the total world's output of silver was produced last year. Gold and silver, since 1904, have produced dividends of $89,000,000 from these districts. The cost of mining, milling and refining per ounce of fine silver produced in 1918 by the Coniagas Company amounted to 41.35 cents.

In the practice of recovery from Cobalt ores, various processes are followed. Jigs and tables will recover a large percentage. Following grinding may come cyanidation, flotation, or treatment with hypochlorite-cyanide. By this latter process concentrates are treated. Five to seven tons of ore are charged into a tube mill and ground with water to a pulp. The tube mill is revolved 18 hours in order to get the necessary fine grinding. Calcium-hypochlorite is added at rate of 50-75 lbs. per ton of ore, depending on sulphide content and the grinding continued six hours. The pulp is fed into a Dorr, classified, and a separation made of the coarse metallic silver and the slime pulp. The metallic silver is re-charged into the tube mill for further grinding. The slime overflow is settled in a collecting tank and the pulp is further de-watered in a vacuum filter. The de-watered pulp is discharged into a cyanide treatment tank at a dilution of 20 to 1 in a cyanide concentration of 0.5 per cent. Agitation and aeration follow for 14 hours. The solution is again decanted and thickened pulp filtered and the 50-75 ounces of silver along with cobalt, nickel and arsenic goes to the smelter.

There are now ten mills in the Cobalt district using the flotation process with a daily capacity of 2,000 tons. Both the Callow pneumatic and Groch centrifugal types are used. The oil mixture in general use is made from 20 per cent. pine oil, 70 per cent. coal-tar creosote and 10 per cent. coal-tar, and in amount runs from ¾ pound to 1½ pounds per ton.

There are now three companies in Ontario smelting and refining Cobalt ores. Partial refining may be accomplished by smelting. Silver buttons containing 15 per cent. antimony and other impurities are obtained. Arsenical fume is collected in cloth dust filters and the white arsenic goes to the plate glass works and for insecticides. During the war, metallic arsenic was needed and was produced by reproduction of white arsenic with carbon in cast-iron retorts. Silver is refined both on the hearth and by electrolytic treatment. From the speiss, which is a complex of many metals, the silver may be taken out with sodium cyanide and the cobalt and nickel by dissolving roasted speiss in sulphuric acid. After treatment, the cobalt and nickel are precipitated as hydroxide successively by hypochlorate and alkali. This produces oxides of these two metals. Most of the cobalt used in the world is made in Canadian works by reduction of the oxide with carbon and melting the metal in an electric furnace. All the cobalt produced is utilized in form of enamels, ceramic colors or "stellite."

As investigational and prospecting work goes on, the future of Greater Ontario becomes more and more assured.

LIMITATIONS OF RESPIRATORS AND ARMY GAS MASKS.

There is a popular belief that the gas masks used in Europe to protect soldiers against certain gases used in warfare are proof against the harmful effects of many of the fumes and gases in industrial plants and mines. The Bureau of Mines at Washington is actively campaigning against this belief. A mask that will protect against poisonous attacks of special gases in the open air is of no use in the presence of illuminating, natural, producer, or blast furnace gases. The limitations of our army gas masks are less than one or two per cent. Within these limits they will protect against the following gases when mixed with air: Sulphur dioxide, hydrogen sulphide, chlorine, carbon bisulphide, nitrogen peroxide, anoline vapor, benzyl bromide, benzyl chloride, chloracetone, chloropicrin, hydrogen chloride, phosgene, sulphur chlorides, xylyl bromide, stannic, chloride, titanium tetrachloride, and silicon tetrachloride.

This confines the field of usefulness of the army mask to certain chemical industries or around smelters and roasters where sulphur fumes are given off. No protection is given against carbon monoxide or ammonia. Special masks may yet be developed for low concentration of these gases. Oxygen breathing apparatus may alone be used in entering gasoline tanks, towers and other closed spaces. All masks are only absorbing gas filters, and it is obvious that oxygen must be present to sutain life.

THE GROWTH OF CERAMIC TECHNOLOGY.

For twenty years there has been a Ceramic Society in the United States. It has fostered the growth and development of research, both industrial and academic in its own lines at home and in Canada. But slight attention was given to the earlier work prior to the war, but, like everything else metallurgical or chemical, a new day has come. In Canada, we have some clays of considerable value, some graphite, and feldspar in abundance. The ceramics branch of the Department of Mines, Ottawa, has done very good work in assisting individuals, making tests and surveys. We have not had the staff of trained men available that have brought the work to its present stage in other places; but we have resources in our Western and other provinces which in time should allow us, at least, to be fairly independent, as far as the raw materials of the ceramic industries are concerned.

Some conception of the growth of those industries in the United States may be gained by considering the program of the recent meeting of the American Ceramic Society at Pittsburg, where some fifty-two papers were presented. These were of the highest merit and indicated the intensity of the progress so recently made. The Secretary, Profesor C. F. Binns, of Alfred University, directed the appointment of the folowing committees:—

1st, Glass; 2nd, Enamel; 3rd, Pottery and Porcelain; 4th, Refractories; 5th, Brick; 6th, Terra Cotta; 7th, Abrasives. It is evident that as any industry grows the sub-divisions soon begin to multiply.

At the above convention, subjects relating to porcelain, optical glass and graphite met with special discussion. The whole development of graphite in the United States and Canada during the last three years has been accompanied by some freak financing and brilliant research work, and much has yet to be done before anyone can really sum up this very complex situation. The American graphite industries, while promising in many ways, need further substantial development before being rated as "solid."

Mr. E. P. Poste, of Elyria, Ohio, recommends citric and tartaric acids as standards for measuring the effect of common fruit solutions on enameled ware. Work done by the General Electric Co. would show that enameled steel might readily be blistered by air bubbles or entrained gases. In the manufacture of glass pots and the casting of porcelain, all the operations of drying, burning, melting and annealing are carried on under perfect control, both of temperature and time. Much work has recently been done by Prof. Washburn, of Urbana, Ill., on gases dissolved in optical glass. A good glass was placed in an inclosed steel box and exhausted. The combined gas under reduced pressure caused a foaming, leaving a spongy mass. The occluded gases were isolated and measured, showing a total of eleven-hundredths per cent. by weight of oxygen and carbon dioxide. The various ills of optical glass are now well classified and are known by their own names. We have "seeds, striae, stones and strains," and these in turn are subdivided into other classes. We may have, for example, "sheet, band, comet, hair and surface" striae.

The shortening in time for various treatments of glass has been accomplished. Mr. G. W. Morey, of Spencer Lens Company, Buffalo, has met with good success in the introduction of mechanical stirring devices. By such means, he obtained good results and complete treatment in two days.

After much consideration and study, it is now thought that the body of a porcelain showing the highest strength, translucency and resistance to chemical action consists in large measure of interwoven crystals of sillimanite. This would mean a chemical composition of $Al_2 Si O_5$. The sillimanite is gradually produced from the quartz as it is absorbed by the other constituents of the melt. The personalities behind this work have been Messrs. A. B. Peck, J. W. Wright and S. T. Sewell, all of the United States Bureau of Standards at Pittsburg, and Mr. A. S. Watts, of Columbus, Ohio.

Our knowledge regarding the reasons for various compositions in making porcelain is advancing. In good porcelain, there is present 15 to 20 per cent. of quartz, 30 per cent. of feldspar and equal proportions of ball clay and china clay. Other factors are being better understood. Mr. Riddle showed where extra grinding up to three hours seemed to be more important than the percentage of feldspar added to the mixture. The oxides of calcium and magnesium, in small quantities, also shortens the time of "maturing" the melt.

It is beginning to appear that free quartz in a porcelain is the source of many dielectric failures. Mr. C. Trieschel, of the General Electric Co., supports this argument and relates the fact that quartz is affected by the high potential strains of the alternating current. Strain and fracture may be induced in this way and destroy insulators which are otherwise quite free from mechanical defects. There are many oxides that might be used in porcelain in place of quartz, and while the theory of the "piezo-electric" phenomenon may not satisfy the situation, it is evident that large fields still await the research worker in the composition and production of satisfactory insulating porcelains.

A NEW BUILDING MATERIAL.

Mr. R. E. Viens, Chemist of the Testing Laboratory of the Public Works Department, Ottawa, has recently patented (Canadian Patent No. 187899, to which reference is made in this issue) a building material which appears to have considerable merit. A special feature of the material is that it firmly holds nails and screws driven therein. It possesses this characteristic to a greater extent than hard wood. This feature makes the use of the material possible in all forms of building where nails are used. It may be used over concrete tile or other material or with reinforcement instead of concrete, as a base to which a wooden floor may be nailed, In block or brick form, it may be used in a wall or around openings where nails have to be driven. With a reinforcement, it may be used as a roofing material to which shingle or other kind of roofing may be fastened. Further, it may be used as a flooring in itself by treating the surface with a hardener, a filler and paint, varnish or wax. The material may be applied in a plastic state similar to the way in which concrete is applied, or it may be moulded into any desired shape and placed in position. The material was tried out in the new Parliament Buildings at Ottawa and has proved very satisfactory.

THE CHLORINATION OF WOOL.

In order to remove completely any tendency in wool fibre to undergo shrinkage, it is chlorinated by dipping it first into a sulphuric acid solution of about four pounds per 100 gallons and then placing it in a bleaching powder solution. The free chlorine liberated after acting on the fibre reduces altogether its capacity for felting.—*Textile Mercury.*

PROF. T. BRAILSFORD ROBERTSON.

Among recent appointments in Canadian universities, that of Professor T. Brailsford Robertson is among the most interesting. Coming from the University of California, where he was professor of biochemistry and pharmacology, Dr. Robertson is now professor of biochemistry at the University of Toronto. His scientific and academic career has been most brilliant. Scotland has the honor of claiming him as her son, Dr. Robertson having been born in Edinburgh in 1884. A variety of travelling experiences came early in life. At three years of age the island of Anticosti, in the Gulf of St. Lawrence, became his residence for a time. Following a short period there came a series of alternations between England and South Australia. Practically all his early education was obtained in England and

Prof. T. Brailsford Robertson.

his college training at Adelaide University, Australia, where he graduated with high honors in 1905 in physiology and physiological chemistry. Leaving Australia, Dr. Robertson accepted a position in California working under Dr. Jacques Loeb, now head of the Department of Experimental Biology at the Rockefeller Institute, New York. Here he obtained his Ph.D. degree in 1907. Following this, he was acting assistant professor of physical chemistry and electrochemistry for a short period. From 1908 until leaving for Toronto, Prof. Robertson remained on the staff of the University of California, becoming professor of biochemistry and pharmacology in 1916. In 1910 he was married to Winnifred Sterling, daughter of Sir E. C. Sterling, M.D., F.R.S., professor of physiology in the University of Adelaide, South Australia. Prof. Robertson is a member of many scientific societies and assistant editor of The Journal of Physical Chemistry, and of The Journal of Biological Chemistry. He is the author of three books, two of which deal with "The Physical Chemistry of the Proteins," and a third, in lighter vein, consists of stories for children.

About 150 special articles, chiefly on the physical chemistry of proteins (1906-1916), have appeared in The Journal of Physical Chemistry and in The Journal of Biological Chemistry. Since 1908, Prof. Robertson has contributed much study and scientific work to the general advancement of our knowledge of the chemical phenomena underlying the growth of animals.

It may only be added that the University of Toronto is to be highly congratulated on securing for the position of professor of biochemistry a man of such outstanding attainments in this field as those which Prof. Robertson is able to bring to the development of scientific research in this country.

THE MORTERUD SYSTEM FOR CHEMICAL PULP.

A. E. Neilson, of Chicago, speaking before the Technical Section of Canadian Pulp and Paper Association in Montreal, reviewed developments of various processes for cooking pulp. Early digesters were vertical, lead-lined, and heated indirectly by a steam jacket. They worked well for twenty-two years. The sulphite process was started by Mitcherlinch in Germany. The cooking of the pulp was done indirectly by coils in digesters lined with lead and acid-proof brick. Direct cooking by steam was introduced by Kellner and many improvements have been made in various steps in the operation.

The Morterud indirect process was introduced in 1900 in Europe and has had a gradual development. It is now used in the larger European mills. It has always been known that indirect cooking of pulp gives stronger quality, a saving in sulphur, and a higher yield from the wood, but the cooking is long and coil repairs are expensive. The distribution of coils also causes uneven cooking. The Morterud process of indirect cooking aims to combine advantages in such a way as to make this very desirable theoretical method a most practical one. Careful study has brought out solutions to former difficulties and the right proportion of the size of the heating surface to the speed of circulation and volume of digester as well as the size of pipes and the distance between them has now been fixed. Precipitates on the tubes have been overcome and the correct regulation of acid by transfusion can be accomplished. With the Morterud process, the liquor contains 50 per cent. more solid material than with direct cooking and in all plants where by-products are considered, this is very important.

A NEW OPPORTUNITY FOR STUDENTS.

The General Electric Co. is initiating a new plan whereby it will be able to engage a number of senior students in chemistry, physics, and engineering during summer months. These men will be placed on problems for which the facilities of working have already been somewhat prepared. Problems will be selected in such a way that the students will be allowed to publish an account of everything they may accomplish. In this way it is hoped to carry on much research work, mostly along the lines of pure science. It is estimated that the introduction of these men to the laboratory at Schenectady, N.Y., will not only be beneficial to them, but also to the members of the regular research staff who will act as their directors during the period of their connection with the company.

CHEMICAL SOCIETY NEWS

Canadian Pacific Section, Vancouver, B. C.

The first regular meeting of the Canadian Pacific Section of the Society of Chemical Industry was held on the evening of January 20th, at the Vancouver Chamber of Mines, when Mr. W. S. Barwick, of the Vancouver Engineering Works gave an interesting technical paper on "Ferro-Alloys and Their Uses in Steel Making."

The various ills that affect steel and iron, their causes and the methods developed by metallurgical chemists in overcoming them were described at length. The more important elements used are, carbon, manganese, nickel, aluminium, chromium, silicon, titanium, molybdenum, vanadium and tungsten.

Most of these are manufactured as alloys with iron by the use of the electrical furnace. Their function is usually two-fold. They act as cleansing agents, removing undesirable constituents, such as sulphur, oxygen, hydrogen and nitrogen. "At the same time," said the speaker, "their presence imparts added properties to the steel, such as hardness, toughness, elasticity, magnetism and resistance to acids, rusting or tarnish. Sulphuric acid is shipped in tank cars made of ferro-silicon. Nickel, chromium and molybdenum steels are used in armour plate or ordnance manufacture. Manganese steel is extremely resistant to wear, and hence is used in mining machinery, railway switch points, etc. High-speed tool steels containing tungsten, unlike the human element, do not lose their temper when they get hot. Chromium steel resists tarnishing agents, and is hence used in cutlery."

The physical and chemical constitution of steels, and the changes in properties brought about by heating and tempering, were graphically illustrated by diagrams. The celebrated Toledo blades of the ancients are known to have contained tungsten, manganese, nickel, etc.

Mr. Barwick frequently quoted from his experience in the manufacture of steel, and paid tribute to various British, French and American chemists who have made contributions, to our knowledge, of metals upon which the progress of civilization is based.

In the discussion following Mr. Barwick's address, Mr. R. C. Campbell-Johnston suggested the possible use of manganese metal in improving steel. This element has been found useful in copper and brass manufacture, and is made at Shawinigan Falls, Quebec, in large quantities by electrolysis. Reference was also made to the cobalt-chromium alloy known as "stellite," produced in Ontario. This alloy will scratch the hardest steel ever produced.

Montreal Branch, Canadian Section.

A meeting of this branch was held at the rooms of the Engineering Institute of Canada, January 10th, 1919, Dr. J. S. Bates acting as chairman in the absence of Prof. Evans. Regulations regarding Associate Members were adopted and two main resolutions passed: (1) That the position of secretary to the executive committee be made a paid position in view of the rapid development of chemical industry in Canada; (2) That the Canadian Section establish a bureau of employment in view of the fact that those industries particularly affecting chemists are undergoing much disorganization.

Mr. C. H. Hazen read a paper dealing with "The Proper Utilization of Coal." The speaker dealt in a most interesting manner with the effect on efficiency of variations in the detail of the design of boilers and boiler sittings. Many steam engineers were present and a very instructive discussion resulted. In particular, everyone appreciated the remarks of Mr. Balmfirth on the human factor in fuel efficiency.

Toronto Branch.

At the Engineers' Club on Thursday, February 13th, Dr. Saul Dushman, of the research staff of The General Electric Company, Schenectady, N.Y., gave a most interesting illustrated lecture on the work this company has done on general research lines. The organization of the laboratory was discussed and the development of special apparatus from the laboratory to the plant was shown. The meeting was very largely attended and prominent representative men from the business and newspaper world of Toronto were present and spoke. Their points of view greatly assist the technical man and create a much-needed common plane of thought. Following his main address, Dr. Dushman made a strong plea for more assistance from the Government in the matter of financial research at our universities. The building up of any central institution, in his opinion, should not delay rapid developments in our universities. Recent United States movements along these lines were discussed.

Mr. Theo. H. Wardleworth, of Montreal, in moving a vote of thanks to Dr. Dushman, recalled a visit he made to the great laboratory of The General Electric Company at Schenectady, where he met Dr. Whitney. He visited Schenectady seeking some light on a process for large quantity production of metallic magnesium in the interests of the war work of the Imperial Munitions Board, but Dr. Whitney referred him back to the laboratories of Canada. Returning home dissapointed in the quest, they set out to work at Shawinigan Falls and not only solved the problem of making the Canadian magnesium from Canadian ores, but they produced it in a higher degree of purity and, as it afterwards transpired, had it ready for the market before the laboratory at Schenectady had developed its processes. However, it is to the credit of the laboratory of The General Electric Company that work has revealed some of the fairy tales of science and the victories of the war may be described as the victories of the chemical laboratories. In these victories the laboratories of the United States and Canada have earned honorable distinction.

Dr. W. L. Goodwin, of Queen's University, in seconding the vote of thanks, said that when Dr. Dushman described the adventures of the two lonely molecules in the high vacuum, he illustrated the great gap which once existed between pure science and applied science, but which seemed now about to disappear in the rapid transformations of to-day. The investigations of a Langmuir yesterday were turned into industrial uses by Coolidge to-day, so that it is a hopeful change when we find that the investigating laboratory may have its immediate influence upon the industrial policy of the country.

Ottawa Branch.

The third regular meeting was held on February 20th, at which an address was given by Mr. S. J. Cook, the local secretary, on the subject of "Paint Pigments: Their History and Development." Mr. Cook treated the subject briefly from a historical point of view and then, after offering a classification of the various pigments as they occur in commerce, proceeded to discuss particularly the white pigments and inert fillers. After the paper, the customary lively discussion took place, many of the members adding to the enjoyment and profit of the evening in this way. The Society

was honored by a visit from the chairman of the Canadian Section, Dr. W. L. Goodwin, of Queen's, who added not a little to the pleasure of the evening by entering into the discussion with the whole-souled enthusiasm so much appreciated by his friends. Thirty-six members and guests were present and the evening was quite up to the Ottawa standard.

A special motion picture meeting of the Society of Chemical Industry was held on February 6th in the Exhibits and Publicity Branch of the Trade and Commerce, at which about forty members and guests were present. Through the courtesy of the American Cyanamide Co., films portraying the processes in use at their Niagara Falls plant were shown. Dr. Shutt, in a few introductory remarks, traced the development of the various processes for the fixation of atmospheric nitrogen and discussed the importance of the nitrogen compounds not only to the vegetable but to the animal world as well. He dwelt on the uses of cyanamide as a feltilizer and as a source of nitric acid and ammonia, and concluded by tendering the thanks of the Society to those in charge of the exhibition, as well as to the American Cyanamide Co., of New York and Niagara Falls, Ont., for the loan of the feature film.

After the showing of this film, Mr. Norrish, the Director of the Branch, supplied a further programme consisting of a film on the manufacture of pottery, another on wooden shipbuilding in Canada, and a third revealing some of the beauties of Banff Park, around Lake Louise.

CONCENTRATED AIR FOR COMBUSTION FURNACES.

At a meeting held at the Chemists' Club, New York, January 17th, at which Dr. Frederick G. Cottrell, Chief Metallurgist of the Bureau of Mines, Department of the Interior, was presented with the Perkin medal for distinguished service in chemical research. Dr. Cottrell, in accepting the honor, outlined certain investigations now being undertaken by the Metallurgical Division of the Bureau, which, if successful, will result in a real revolution in the fundamental industries.

Dr. Cottrell, in telling the chemists of this important work, said, in part:

"When, at the suggestion of Sir William Ramsay, the British Admiralty first studied the possible use of helium for balloon purposes, they felt that the expense of production would be prohibitive. First, on account of the great scarcity of the element and the very great dilution in which it was found in the atmosphere (1 vol. in 250,000) and in other gases; and, second, because of the expense of the processes of separation then known to the Admiralty.

"When this information came to the U. S. Bureau of Mines, it was remembered that some of the natural gases of Kansas, have been found by Dr. H. P. Cady, of the University of Kansas, to have over 1 per cent. of helium in them. The separation of helium from these gases could best be accomplished by the same general processes of liquefaction and distillation as are used to separate air into its nitrogen and oxygen for industrial purposes.

"It so happened that the Metallurgical Division of the Bureau of Mines had been making a study of these processes, in the hope of finding a way to sufficiently cheapen the production of oxygen from the air to allow its general use in metallurgical furnaces and other large scale chemical and industrial operations. If this were possible, it would work a real revolution in these fundamental industries. Take, for instance, the smelting industry alone. We now concentrate everything that goes into the furnace (coke, ore, fluxes, etc.), except the oxygen of the air which we add with four times its volume of inert nitrogen, and thus undo much of the effect of the concentration of the other constituents. If we could use pure oxygen, or more concentrated air, a great saving could be effected, and we could do in combustion furnaces much which is now only possible in the electric furnace.

"One of the processes which the Bureau had felt had much promise in this direction had not, up to this time, received any large scale development, but now these facts were all called to the attention of our army and navy, who immediately jointly appropriated, first, $100,000 and afterwards further sums, now aggregating over $1,000,000, for trying out the project, not only along the line of the new process, but also parallel therewith by the older and better known processes as well, and entrusted the general direction of this work to the Bureau of Mines.

"The plants on the older processes are already producing helium in large quantities and the one on the new, and what it is hoped may prove several times more economic basis, is just about to have its practical production test.

"If it fulfills anticipations, its significance is far wider than the production of helium, for it will open the possibility of oxygen in quantities at costs undreamed of by most chemists and metallurgists."

MANUFACTURE OF SODA ASH IN CANADA.

The estimated consumption of soda ash in Canada is now 50,000 tons. During the past four years the lack of soda ash has been felt by a great many of our industries. We were entirely dependent on foreign supplies. Most of the soda ash used here came from England, and, with the war, Canada was practically shut off from supplies. Now, however, the Brunner, Mond, Canada, Limited, have their new plant at Amherstburg, Ont., practically completed, and they are in a position to supply Canadian requirements. They are using the "Solvay Process," by which practically all the soda ash now produced is made. The town of Amherstburg is well situated, and the raw products: salt, limestone, and ammonia, are easily available. A tract of land of 650 acres was secured, and a main building, 170 x 190 feet and ten stories high, was erected. The plant has one of the largest lime kilns known, being 80 feet high. Taken altogether, it is one of the most complete soda ash plants in the world, and is designed in such a way that the capacity may be readily increased with the demand. The company produces its own power, and obtains its salt from wells practically at the plant. The limestone used is also taken from quarries on the property.

The produced soda ash is of general use in the manufacture of glass, soap, paper, wood-pulp, paints, leather, enamelled ware, cleansers, textiles, oil refining, metal working, and metallurgical operations, washing powders, chemicals and drugs.

It is a real Canadian chemical industry, using Canadian labor and raw materials, and manufacturing a product of prime importance to many industrial operations. Mr. G. S. Rutherford, born in Montreal and a graduate of McGill, is managing the plant.

The Need for a Canadian Organization of Chemists

By Harold J. Roast, F.C.S.

An address given before the Montreal Branch of the Canadian Section, Society of Chemical Industry.

I AM here to speak not so much *for* the Chemists of Canada and *their* need of organization as *with* the Chemists about *our* need of organization.

Why is organization needed? Why not let us each pursue his own course alone?

It is hardly necessary to bring up arguments justifying such organization; yet, inasmuch as I have met a few chemists who saw absolutely no need of organizing, some discussion of this point had better, perhaps, be entered into.

If each individual could live and die so far as his business or professional life was concerned, to himself, if he never changed from one position of activity to another, if the knowledge he possessed was entirely and always sufficient for all the problems he had to face, if legislation either never affected him or was always favorable to him and to his activities—then he would probably have nothing to gain and even something to lose by becoming a part of any organization affecting his profession, inasmuch as the becoming a part of an organization either entails work or at least the responsibility for work in one form or another.

Everyone knows, however, that no man lives and dies unto himself, in business or professional life any more than in social life. Most of us, especially in a new and developing country like Canada, realize that it is the exception, not the rule, to remain a lifetime in one particular position, and all of us, not once but many times have realized the insufficiency of our knowledge in dealing with some new and, it may be, unexpected problem with which we are confronted, and most of us probably have felt the injustice of legislation that describes some activities as professional, whilst others, of surely equal standing theoretically, are not so described. Further, few of us probably are satisfied with the position the chemist has held, or at least the recognition that he has obtained during the Great War, reading, as we did, of "flying corps," "medical corps" and "tank corps," whilst such a thing as a chemist's corps was unheard of. We all realize the work the chemist has done in connection with the war, that it remained for the United States Army Department to officially recognize the chemist by creating a chemical division with special insignia, viz., the two inverted alembics on the uniform of officers and men, all of whom were chemists. Surely this was a step in the direction of raising the status of the chemist.

Further, let us inquire as to what activities are generally recognized as professional. We shall probably be told law, medicine, architecture and engineering. As a matter of fact, we shall find on more careful inquiry that surveying is a distinct profession legally, while engineering is, I am told, not legally recognized as a profession. The main point is, however, that it is beyond dispute that all these bodies have attained recognition as being honorable professions to which it is a social distinction to belong, that a person in any of these professions finds very considerable help in his membership thereof, and the satisfactory development of each of these professions has been due to *organization*.

If, then, the chemist admits his dependence upon others in the profession the likelihood of his requiring more than one position in the course of his career, the need of outside assistance of a fellow craftsman from time to time, and the need of beneficial legislation to benefit both himself and the industries with which he is associated, and if he desires that his standing as a chemist should equal that of a member of the legal or medical profession; if he admits these things, surely he must admit the need of *organization*.

To leave other activities now, and to turn to our own activity, which we at least will call a profession, let us see what has happened in England.

The oldest Society of Chemistry in England is that known as the Chemical Society of London, founded in 1841. This society was the only society of importance devoted exclusively to the interests of chemistry in England, or, indeed, in any other country. It obtained a Royal Charter in 1848. The French Chemical Society and the German Chemical Society were formed respectively in 1857 and 1868.

Feeling that a knowledge of what has been done in England in the way of organization of chemists would be useful as a guide to our development in Canada, I have made up a synopsis of the history of the Institute of Chemistry of Great Britain and Ireland, following this with a brief outline of the development of the British Association of Chemists.

On Opril 27, 1876, in the rooms of the Chemical Society, a few chemists interested in organization met. They appointed a committee of ten to confer with the Chemical Society with a view to carrying out a scheme for establishing an organization of professional chemists of Great Britain and Ireland, subsequently changed to the Institute of Chemistry of Great Britain and Ireland.

The committee reported that the Chemical Society found itself unable to undertake the organization, owing to the limitation of its Charter. It was then decided to take the necessary steps to secure the formation and incorporation of a proposed new association. On February 24th, 1917, at a meeting of the committee, a report was read of a sub-committee (appointed in the interim) giving a draft scheme for the organization of professional chemists. This, with slight modification, was unanimously adopted and forty-eight gentlemen were elected as *the First Fellows of the Institute*.

The first officers and council were also elected with president and secretary. The entrance fee was fixed at $26.00, and the annual subscription, $10.50. Fellows and associates existed from 1878. In 1885, the Institute was incorporated by Royal Charter. In 1892, examinations were made more strict and the Institute acquired its own premises and laboratories. In 1898, the Government recognized a special examination by the Council of the Institute for the position of Public Analyst. In 1903 the first president to represent Industrial Chemists was elected.

The organization committee had also decided that each nomination for membership should be supported by five members and that the votes of four-fifths of the Council of the proposed Institute should be required for valid election.

With regard to works chemists, it was agreed that those who could show that they had been satisfactorily trained, and had been engaged in the practice of their profession for at least five years, should be placed on the same footing as private practitioners. This decision was reached in 1876.

After incorporation, the following qualifications were required for Fellowship in the Institute: That the applicant be not less than 24 years of age, that he had passed through

a course of three years' training to the satisfaction of the Council in theoretical and analytical chemistry and physics, and had subsequently been engaged for three years either as assistant to a chemist of repute or as a professor or demonstrator of practical chemistry at some known university, college or medical school, or *as a chemist in a technical industry;* or had, after three years' training as above, conducted and published an original research of sufficient merit in the opinion of the Council on some chemical subject requiring practical work; or, that he had been trained and occupied in other ways which, in the opinion of the Council, were equivalent to fulfilling the above conditions.

A phrase used by a member of the Institute in 1892 is worth repeating. He said: "Looked at from within, some might say that it was in order that chemists might form a close profession; looked at from without, the public would say that it was *to collect together a body of men who could be consulted with confidence.*" This last phrase is worthy of serious consideration and is, to my mind, the underlying principle of any organization of chemists.

The management of the affairs of the Institute is vested in a council consisting of not more than 36 Fellows, including president, six vice-presidents and honorary treasurer. The Council is entrusted with the appointment and removal of officers and staff of the Institute, to decide on all applications for examination and final membership.

On April 27th, 1918, as a result of the activities of the British Association of Chemists, an extraordinary general meeting of the Institute was called to consider the modifications of the regulations for admittance to the Institute with a view to including all qualified chemists.

The Institute has from time to time been consulted by the Government as to procedure concerning chemical matters and in the meantime has interfered in the interests of chemists as affected by local regulation, such, for instance, as a small scale remuneration proposed by a local County Council. It maintains a register of Chemists and positions available, and in other ways bestirs itself in the interests of the chemist.

Turning now to the organization of the British Association of Chemists: In the latter part of 1916 a gathering of chemists in Birmingham (and later, although independently, in Manchester) formed a provisional committee which drafted various proposals regarding the formation and objects of a "British Association of Chemists." This committee convened a meeting at Manchester on November 10th, 1917, which was attended by over 600 chemists, this being the largest gathering of its kind ever held in England. The resolution submitted dealt with:

1. The desirability of forming an association.
2. The qualifications for membership.
3. The objects of the Association.
4. The best means of obtaining them.

The speakers included Chairman Dr. A. Ree, Dr. R. B. Foster, Mr. E. W. Smith (the former gentleman being the chairman of the Manchester District Committee, and the latter the chairman of the Birmingham District Committee, and Mr. Edward White, *President of the Pharmaceutical Society;* also Professor G. T. Morgan and Professor Findlay, representing the Council of the Institute of Chemistry. The following resolutions were passed:

1. That it is desirable to form a British Association of Chemists.

2. That the objects of the Association be as follows:

(*a*) to obtain power to act as sole registration authority for all chemists,

(*b*) To have the word "chemist" legally redefined.

(*c*) To safeguard the public by obtaining legislation and showing that certain prescribed chemical operations be under the direct control of a chemist.

(*d*) To raise the profession of the chemist to its proper position among the other learned professions, so that it may attract the attention of a larger proportion of the best intellects and thereby secure a supply of highly trained chemists adequate to the industrial needs of the country.

At this meeting it was decided to approach the Institute of Chemistry before going further, with a view to seeing if the Institute was willing to cover the points mentioned in a satisfactory manner. On January 12th, 1918, meeting of northern chemists was held at Newcastle under the auspices of the Society of Chemical Industry to consider the formation of a local branch of the British Association of Chemists. Mr. Peile said that the Society of Chemical Industry was absolutely neutral in its attitude towards the proposed association, but considered that the project was one which deserved the fullest consideration.

Brief descriptions were given of the aims and history of the Chemical Society, the Society of Public Analysts, the Society of Chemical Industry, the Pharmaceutical Society, and the Institute of Chemistry, and resolutions endorsing those of the Manchester meeting were carried.

A similar meeting with similar results took place at Huddersfield.

On February 2nd, a meeting was held at Leeds, where Dr. R. B. Foster stated that the *Institute represented* 1,500 *chemists, while there were at least* 5,000 *properly trained chemists in the country.*

On February 4th, a meeting was held in London, Mr. Ling, vice-president of the Local Societyof Chemical Industry, being in the chair. Similar discussions took place as at the previous meetings, favorably to the new Association.

The following are the proposals submitted by the British Association of Chemists to the Institute of Chemistry:

(a) That the Institute of Chemistry should become the sole registration authority for chemists—an authority bearing no relation whatever to the granting of the diplomas A.I.C. and F.I.C.—with a view to the Institute carrying out the objects of the proposed British Association of Chemists as outlined in the circular calling the meeting held at Manchester on November 10th, 1917.

(b) If the Institute cannot see its way to modify its constitution to carry out the first proposition, that it should adopt as a minimum qualificationf for A.I.C. the A. and B. qualifications of the British Association of Chemists, and adopt as a minimum qualification for A.I.C. the A. and B. qualifications of the proposed British Association of Chemists, and adopt the objects outlined in the circular convening the meeting held on November 10th, 1917, providing that *after* 1921 only persons qualified under (a) of the British Association of Chemists qualifications be eligible for A.I.C.; (c) that local sections should be formed, and that the Council should consist largely of representatives from such sections. The qualifications referred to as (a) and (b) are as follows:

(a) The holding of a university degree (or its equivalent) with chemistry its principal subject.

(b) The production of satisfactory evidence of a sufficient general education and of having practised pure or applied chemistry for not less than seven years; the holding of a responsible position. This clause to be applicable only until December 31st, 1921.

Various meetings of the Institute of Chemistry then followed throughout the country, some for and some against the enlarging of the scope of the Institute along the lines of the British Association of Chemists.

At this time, a Mr. F. I. Scard, dealing with the outline of an Act to be brought before Parliament, said: "The chemists coming within the meaning of this Act to consist of all persons who, at the time of the passing of the Act, shall be carrying on the business of consulting, analytical or technological chemists or who shall be subsequently registered as such *under a qualification to be determined.* The provisions of the Act to include the formation of a council of which the constitution might consist of members nominated by the various recognized societies and institutions together with the nominees of the Crown. The duties of this Council under the Act to be:

1. To keep a register of analytical and technological chemists.

2. To fix the qualification for registration of such consulting, analytical and technological chemists, as shall not be in business at the time of the passing of the Act.

3. To deal with unprofessional conduct on the part of registered chemists and to take proceedings against unregistered persons carrying on business as consulting, analytical or technological chemists, powers for these purposes being given in the Act.

4. To carry out in general the provisions of the Act.

The above, says Mr. Scard, would in no way interfere with the operations of the present Chemical Societies and Institutions.

On April 27th, an extraordinary general meeting of the Institute of Chemistry was called, which essentially endorsed the proposition made by the British Association of Chemists. This was followed by a meeting of the British Association of Chemists which decided that inasmuch as the Institute had undertaken to carry out the plans of the British Association of Chemists, it was no longer necessary to continue the latter organization. This resolution was confirmed at the National meeting of Chemists held on June 15th, 1918, with about 400 chemists present, one-third of whom qualified under (a) and two-thirds under (b) qualifications of the British Association of Chemists. A large majority were in favor of the work being continued by the Institute of Chemistry, a small majority were in favor of still continuing the British Association of Chemists, and a resolution was passed to hold a meeting of the British Association of Chemists in October, and "that a register of members be prepared on the basis of the British Association of Chemists' accepted qualifications." Dr. Ree resigned, as he objected to continuing the British Association of Chemists.

The latest news of the British Association of Chemists is contained in the current number of the Journal of the Society of Chemical Industry, where it is stated that at a meeting of the Leeds and Bradford Sections, held in Leeds on October 11th, Mr. D. Hickson presiding, the draft regulations of the Association were discussed and approved with only two modifications. It was thought that teachers of chemistry should be eligible for admission, and that in regard to the second of the declared objects of the Association, the words "British Empire" should be substituted for "Great Britain and Ireland." In explaining the proposed qualifications for membership of the Association, the chairman said that a pass degree fortified by three years' practice would rank equally with a first or second-class honors degree, and he expressed his confidence that any applicant *possessed of a good general education and not less than seven years' experience* would obtain admission. The meeting also approved of the proposed issue of an official record of the proceedings of the Association six times a year.

Let us now turn our attention to matters entirely Canadian.

The question arises, What will organization do for the profession of chemistry in Canada?

In the first place, organization will bring into being a corporate body capable of representing the profession at times of local, provincial or national crises. In the second place, such a body, acting as a unit, will be able to acquaint either the public as a whole or any special portion thereof with facts of special importance both to itself and the chemist. In the third place, such a corporate body, duly recognized by the public, would, by carefully framed requirements for membership, raise the status of the profession by drawing a beneficial comparison between its members and those outside—in other words, prevent the genuine chemist from suffering from association in the public mind with some whose want of knowledge and consequent errors cause them to be distrusted. Such an organization would bring about a greater interchange of thought and personality between its members; such an organization might well afford facilities for its members to get into touch with those who require their services; such an organization might readily enable any one of its members to obtain from another member or members information to supplement his own knowledge on any particular problem. That is to say, it could be a clearing house for professional knowledge. Such an organization would be the reasonable channel through which to obtain legislation of any desirable nature.

Under the head of Publicity might well come the need of a professional remuneration for professional men, the need of professional oversight of certain classes of manufacture (one might almost say of all classes of manufacture). The accomplishment of all these things, or even some of them, would undoubtedly help the chemist and at the same time assist materially in protecting the public.

A question likely to arise in the minds of some at this stage is, *Are there no chemical societies in Canada taking care of these very questions?* The answer must be in the negative, because most of the questions raised require an organization composed *only* of chemists. There is not in Canada at the present time any chemical society composed only of professional chemists. It is not surprising, therefore, that with such a need existing amongst chemists, open expression should have been given to it at the first convention of Canadian chemists held in Ottawa last May.

This convention appointed a committee with power to add to its members, to feel out the pulse of the chemists of Canada, to formulate a plan for a Canadian association of chemists, and to report on the same at the next convention.

The committee has been successful in securing the hearty co-operation of our confreres, the French-Canadian chemists. Five meetings of the committee have been held—two in Ottawa and three in Montreal. As a result of these meetings, certain broad lines of organization have been discussed.

It would appear best to start the new organization with a number of charter members to be chosen from representative classes, these to be men of undoubted standing as chemists, and in whom the average chemist of Canada might safely place his confidence. Such a body of charter members appointed at the next convention would in due course apply for a charter along the lines laid down by their legal advisers.

The organization being then formed, membership requirements would be formulated and applications for membership received, (in the appointment of the charter members it might well be advisable to acquaint them with the Convention's idea as to the membership requirements before asking them to become charter members), after which the organization would develop along the lines of the requirements of the chemists of Canada.

Gentlemen, I have endeavored to briefly bring before you the need of organization and to sketch in a broad way the lines along which such organization might be accomplished. What is needed, however, is the viewpoint of the average chemist of Canada, which can only be attained by getting the expression of opinion of as many individual chemists as time and place will permit.—(Montreal, Nov. 27, 1918.)

TEACHING OF SCIENCE IN SECONDARY SCHOOLS.

A meeting was held on February 13th in the Faculty Union of the University of Toronto to discuss the report of the committee appointed by the British Government to consider the teaching of science in the schools and colleges. A large representation from the staffs of all the faculties was prsent. Professor George A. Cornish opened the discussion by outlining the recommendations of the committee. He pointed out some facts the University of Toronto had to learn from the committee's report. Science courses extending over three and four years in the secondary schools are largely ignored by the University, and students, who have covered such courses, on entering the University, have to take elementary work with students who have no previous scientific knowledge. The committee strongly recommend that students should not be asked to duplicate work which they have already done in the secondary school, whether they are in the University, the Medical or Engineering School. The speaker also criticized some of the science departments of the University in their indifferent attitude toward the science work of the secondary schools. In the struggle for the advancement of science in the schools, little assistance had been received from the University. The discussion was very animated. Professor Allen, of the Chemistry Department, and Professor R. B. Thompson, of the Botany Department, explained their attitude, which was friendly, toward the science teaching of the schools. Dean Baker stated one of the drawbacks of chemistry and physics was that students could not continue the pursuit of these subjects after leaving school. He recommended that, in order to overcome this difficulty, every town and city should establish a public laboratory, very much as a public library is now established, and that any person who wished should be allowed to use it for experimental purposes.

THE PROTECTION OF METALS.

The Calorizing Corporation of America, Detroit, Mich., have recently published an account of the development of calorizing. W. E. Ruder, of the General Electric Co., describes the numerous applications of this new process to iron, steel, copper, nickel, and brass. Wherever metal equipment is subjected to high temperature, the process will be of value. The little booklet of 40 pages covers many specific applications.

LATEST CANADIAN CHEMICAL AND METALLURGICAL PATENTS.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

Method of Refining Zinc, S. Huldt, 188,176, Jan. 7, 1919. Zinc containing Pb is refined by providing a molten bath having a vaporizing surface properly proportioned to its depth, so that the Pb will not be vaporized. The bath constitutes a heat magazine for counterbalancing variations of temperature.

Purification of Alumina, J. W. Hornsey, 188,441, Jan. 28, 1919. Impure Al_2O_3 resulting from the calcining of alunite and the leaching of the calcine is mixed in a finely-divided condition, with water to form a pulp, which is subjected to flotation with the addition of oil, thus separating the Al_2O_3 in the form of froth and the Al_2O_3 is then recovered from the froth.

Treating Copper Ores by Lixiviation, N. C. Christensen, 188,291, Jan. 14, 1919. Cu ores are lixiviated with concentrated SO_2 solution by first bringing the solution in contact with relatively weak SO_2 gases and then successively bringing the same solution in contact with successively strong SO_2 gases. Lime is added to ppt. practically all the Cu as $CuSO_2$ and all the sulphate combined with Cu as $CuSO_4$, when excess SO_2 is removed from the pregnant soln.

Composite Fuel, Wm. Clayton, 188,318, Jan. 21, 1919. The fuel contains coal screenings 20, charcoal or peat 10, loam 25, clay 10, sawdust 15, sand 5, lime 2, linseed or crude oil 13.

Electrolytically Producing Iron, A. T. C. Estelle, 188,462, Jan. 28, 1919. Fe comps. are treated with caustic alkali at high temp. and the slime produced is subjected to electrolysis.

Crude Cyanids, Horace Freeman, 188,258, Jan. 14, 1919. A composition containing 20 per cent. of an alkali metal cyanid mixed with an alkali metal chloride, an alkali chloride, CaO and C is used in the extn. of Au from its ores.

Treatment of Zinciferous Ores, P. M. Gillies, 188,033, Dec. 31, 1918. Complex sulfid ores are treated after roasting and crushing with H_2SO_4 to dissolve the ZnO, the $ZnSO_4$ soln. is then purified with H_2S and electrolyzed.

Treating Ferruginous Waters, L. S. Hughes, et al, 188,305, Jan. 21, 1919. Ferruginous water is subjected to the action of an oxidizing agent to convert ferrous into ferric salts, then to the action of limestone to partially neutralize the water and ppt. the iron as a ferric and then to the action of magnesite to complete the neutralization and pptn.

Briquetting Machines, T. Gilmore, 188,436, Jan. 28, 1919. Structural features of a machine for briquetting, preferably metal or mineral fines without the use of a binder.

Means for Repairing Furnaces, N. F. Ackerman, 188,469, Jan. 28, 1919. A supporting head movable with respect to the furnace and shaped in conformity with the part of the furnace to be repaired, has a water supply operatively connected to it for cooling purposes. By means of this device, a furnace may be repaired without cooling.

Process of Obtaining Molybdenum, James A. Holladay, 188,089, Dec. 31, 1918. Wulfenite conc. or similar material is smelted to eliminate Pb and produce a sol molybdate slag, which is leached with a dil. soln. of a Ca salt. The Mo is pptd. as Ca Mo O_4 and the latter smelted with Si to recover the Mo.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa.

(NOTICE—Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

Department of Finance.

War Thrift Book. 59 pp. Free.

Department of the Interior.

Soldiers' Settlement Board of Canada. 24 pp. A handbook giving information regarding land settlement and agricultural loans for returned soldiers.

Report on Irrigation and Inspections—1917-18. 47 pp. Beginning with a Roll of Honor, listing the names of those enlisted for overseas service from the Irrigation Branch, this little report gives in succinct form the work that has been carried on during the year by this Branch. It consists of two reports: that of the superintendent of irrigation and that of the commissioner of irrigation. During the last year there has been little development with irrigation because of the high cost of labor and material. Stream measurements have been made as in former years. Alkali investigations have been made, the work of analysis having been done in the chemical laboratories of the Central Experimental Farm, Ottawa. The report of the commissioner begins with the statement that "all efforts to prepare the report in attractive form have been sacrificed to the direct scheduling of the more important features of the work in brief form." In the pages which follow, the subject of irrigation is discussed with particular reference to the needs of the farmers in the districts where the work is carried on. To all interested in the irrigation lands of Alberta, the report has many features of interest.

Department of Mines.

Geological Survey. Summary Report, 1917, Part C. 59 pp. These reports, which have been mentioned here as they appear, are condensed so that a review is not practicable. Previously, the mention has consisted of a list of contents, and the present will form no exception. The papers, many of which are by different members of the Survey, are on the following subjects: Water Supply in Southern Alberta; Potash in Saline Waters in Saskatchewan; Oil Production, Sheep River Area; Viking-Athabaska Gas Field; Sections Along North Saskatchewan River, and Red Deer and South Saskatchewan River; Peace River Section, Alberta; Explorations in the Vicinity of Great Slave Lake; Crowsnest and Flathead Coal Areas, B.C.; Lignite Area of Southern Saskatchewan; Surface Deposits of Southern Saskatchewan. The whole publication is well printed on good paper and is very condensed.

Department of the Naval Service.

Tide Tables for the Eastern Coast of Canada for the year 1919. 84 pp.

Tide Tables for Nelson, Hudson Bay, and Tidal Data for Hudson Straight and James Bay for the year 1919. 8 pp.

Tide Tables for the Pacific Coast of Canada for the year 1919. 64 pp.

Quarterly Bulletin of Fisheries Statistics, Jan.-Dec., 1918. 12 pp.

Department of Soldiers' Civil Re-establishment.

Report of the work of the Invalided Soldiers' Commission for the year ending May 31st, 1918. 110 pp. Free on application to the Chief of Distribution, Public Printing and Stationery Dept.

Medical Quarterly, Vol. I., No. 1, January, 1919. 56 pp.

Department of Public Works.

Georgian Bay Canal Commission. Interim Report No. 3 By W. Sandford Evans. 53 pp. This report presents certain statistical data which are intended to form a possible basis for the groundwork study of the problems of passenger traffic on the North Atlantic in its relations to general traffic, and of the operation of Canadian mail subsidies and steamship subventions in relation to the general traffic problem. As material for these compilations, returns were obtained from the steamship companies showing traffic by vessels in detail. Some data were obtained directly from the ships' manifests at different ports. These were tabulated and as the time allowed did not permit of a further study being made, this report consists chiefly of the tabulated data. Interesting figures on Canadian immigration and on steamship subsidies are to be found in this report also.

Report of the Minister of Public Works on the Works under his control for the year ending March, 1918. 160 pp. This report comprises the reports of Deputy Minister, Chief Architect, Chief Engineer, General Superintendent of Telegraphs, Collector of Revenue, Chief Accountant, and Law Clerk, officers of the Public Works Department. An alphabetical index covering the contents, forms the first nine pages. The Deputy Minister's Report reviews the others briefly, and from it it is learned that the expenditures of the Department during the year amounted to $14,055,207.70, which is over two million dollars less than last year, and over fifteen millions less than three years ago. Three pages are devoted to a review of the work on the new Parliament Buildings in which contracts and prices are given. The report of the chief engineer gives details of the construction work carried on on Government buildings and also on various waterways in the way of dredging and bridgebuilding throughout the year. In the chief accountant's report a list of all the lands and properties rented by the Government together with the rentals paid should be of interest to those who are continually complaining about the lack of information re the amounts paid by the Government for accommodation. The last two pages tell what very few people in Canada know—the work of the National Gallery of Canada. Purchases and gifts received during the year are also given a place. Altogether it is a very satisfactory report of Government activities in this important Department.

Department of Trade and Commerce.

Dominion Bureau of Statistics.

Monthly Report of the Trade of Canada. November, 1918. xxpp. 365 pp.

Monthly Report of the Trade of Canada. December, 1918. xxpp. 365 pp.

These contain records of the imports entered for consumption, and the exports of Canada as compiled from the records of the Department of Customs.

Census of Industry. Part I. Agricultural Statistics, 1917. xiv pp. in English; xiv pp. French; 47 pp. tables with dual language titles. In this report are assembled all the available data relating to agricultural statistics of the Dominion of Canada for the year 1917. It includes the areas, yields

and values of the principal field crops, the numbers and values of farm livestock, the prices of agricultural products and the trade returns of the imports and exports of agricultural products for Canada, together with comparative figures for previous years and for other countries.

Census of Industry. Part III. Fisheries Statistics. xxii pp. English; xxvi pp. French; 104 pp. tables, as above. This volume is issued under an arrangement for statistical co-operation between the Dominion Bureau of Statistics and the Government branches having jurisdiction with regard to fisheries throughout Canada. The statistics of the catch and of the products marketed in a fresh state or domestically prepared are collected by local officers of the Fisheries Branches, checked in by the Naval Service and compiled by the Dominion Bureau of Statistics.

Monthly Bulletin of Agricultural Statistics, December, 1918. The world's production of grain and potatoes, statistics of creameries and cheese factories, crop reports and weather conditions are followed by tables of prices for agricultural produce at home and abroad.

Commercial Intelligence Branch.

Weekly Bulletins Nos. 782-785. Weekly record of news of interest to the importing and exporting trade.

Food and Drugs Laboratories.

Bulletin 377. Human Food, Considered in Relation to Quantity and Cost. Second Edition, revised. 18 pp. A monograph on the subject by Dr. A. McGill, Chief Analyst. The demand for the first edition was so great that a reprinting was made necessary and Dr. McGill has taken this opportunity to make a few changes and to add some new material.

Bulletin 415. Maple Sugar. 11 pp. This bulletin includes Note 10 on the use of saccharin; Note 11, on currants; Note 12, on the use of the word "maple" in labelling; and Note 13, on separated milk. After these notes there is a report on maple sugar in which tables showing the nature of the adulteration found in samples purchased in the open market are given. The Act, as relating to maple sugar, is quoted and discussed.

Bulletin 422. Bran and Shorts. 7 pp. One hundred and sixty-five samples were analyzed and the results of four The method for the determination of the number of vital analyses are given, these samples being found adulterated. weed seeds is also given.

Bulletin 416. Coffee and Substitutes. 6 pp. One hundred and eighty-seven samples were purchased last year for examination. Of 105 samples of coffee, 5 were found to be adulterated by admixture of roasted grains and chicory. Four samples of "compound" contained none, or only very little coffee. A few notes on methods of analysis are given, but the analyses are not recorded.

Bulletin 418. Cocoa. 18 pp. This paper is a monograph on the subject by Mr. F. C. Collier, Public Analyst, and will undoubtedly be in demand as a readable treatise on cocoa. The source and methods of manufacture are outlined fully and the composition and nutritive value of cocoa products discussed at some length in a popular way. The meaning and significance of the term "soluble" as applied to cocoa is made clear, and this section is followed by suggested standards for the article. The analytical data recorded are explained so that every reader may be able easily to follow what might otherwise prove a technical discussion. Foreign cocoas are compared with Canadian products in an interesting way, and complete tables of analyses representative of 79 samples are given. This paper is probably the only one on the subject published in Canada.

Bulletin 419. Water Glass (Sodium Silicate). 6 pp. This article, which is so much used in the preservation of eggs, comes on the market in small containers mostly, and is very variable in its content of sodium silicate, the range being, according to this bulletin, from 30 to 55 per cent. It is recommended that the article be standardized so that the public may receive a uniform article. Tables of analyses are given.

Bulletin 420. Ice Cream. 4 pp. Tables of analyses showing fat content, cane sugar, and kind of thickener used (if any) for 64 samples are given.

Bulletin 421. Flour Substitutes. 4 pp. Two hundred and sixty-eight samples of various kinds of flour substitutes were examined for the purpose of ascertaining whether these flours were what they purported to be. The Chief Analyst, in this letter, decides that for the most part they were, but remarks that fortunately the conditions which demanded the use of these substitutes have passed away. No analyses are given.

The paper on which these bulletins are printed is much inferior to that previously used, a fact which will be noted with regret by those accustomed to keeping these publications for binding. Many of the publications of this branch are recognized as being distinct contributions to the knowledge of the subjects of which they treat and it seems only fitting that the data should be recorded on paper sufficiently good to insure their preservation.

The Eau Claire Paper Manufacturing Co., Eau Claire, Wis., is, so far as is known, the only plant in the United States producing a filter paper for laboratory use. Wm. Brubacher, formerly chemist with the Dells Pulp and Paper Company, is in charge of the work, which has been going on in a small way for some months.

The removal of the restriction imposed by the War Trade Board of the United States regarding conservation of tetrachloride of tin in dyeing silk, has enabled the silk dyers and manufacturers to return to their former methods of using this material for weighting silk.

Castor Oil:—The United States Government had 100,000 acres growing beans, in connection with their aircraft programme. These beans are being shipped north to three of the largest crushing plants. The Baker Castor Oil Co., in Jersey City; Spencer Kellogg & Sons Co., Edgewood, N. J., and Buffalo, N. Y., and the O. & W. Thumb Co. of Grand Rapids, Mich., are taking over most of the excess crop.

BUSINESS CONNECTIONS FOR CANADIAN EXPORTERS.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, the Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the number of the enquiry. The initials, "B.T.C.," indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

No. 131.—**Canned Goods, Apples, etc.**—London Eng., for European trade.

No. 132.—**Cereals, Dried Fruit, Canned Fruit and Fish**—Yorkshire.

No. 137.—**Strawboards and Pulpboards**—Hull, Eng., orders of 10 to 15 ton lots for strawboards and in 5 to 10 ton lots for pulpboards.

No. 138.—**Leather**—Leeds, Eng., firm.

No. 139.—**Paper and Cardboard**—Leeds, Eng.

No. 143.—**Evaporated Milk**—Hull, Eng.

No. 144.—**Wire Rods**—Warrington, Eng., firm, who use 500 tons monthly.

No. 147.—**Wire Nails, Locks, Hinges and General Iron**—Liverpool, Eng., firm.

No. 149.—**Canned Fruits and Fish**—Liverpool, Eng., firm.

No. 173.—**Crude Oils, Grease and Lubricants, Leather and Shoemakers' Supplies, Harness Oils and Dressings, Canned Goods, Pickled Fish and Oleomargarine**—Commission merchant in Kingston, Jamaica, wants to represent these lines.

No. 160.—**Gold Foil**—Glasgow, Scotland, importer.

No. 161.—**Celluloid**—Glasgow.

No. 162.—**Druggists' Sundries**—Glasgow, Scotland, importer.

No. 164.—**Sugar Corn**—Glasgow, Scotland.

No. 169.—Calcutta, India, Agency—Canadian business man, for five years employed in Calcutta wholesale house, would like to hear from Canadian manufacturers who desire representation in India.

No. 171.—**Sponges, Brushes, Soap, Chamois, Blackings**—Belgian merchant.

No. 172.—All kinds of Canadian Products—Belgian.

No. 176.—**Glucose**—Liverpool, Eng., firm, ready to purchase large quantities.

No. 178.—Any Canadian Product—Belgian commission merchant, nine years in business in Antwerp.

No. 184.—**Pharmaceutical Products**—An Argentine firm.

No. 185.—**Industrial Chemicals**—An Argentine firm.

No. 186.—**Powdered White Lead**—An Argentine firm want quotations c.i.f. Buenos Aires, in casks, of 200 kilogrammes net weight.

No. 187.—**Pressure Gauges, Thermometers**—and similar accessories for freezing plants and sugar refineries. A Buenos Aires machinery house, prices f.o.b. New York; also if possible samples.

No. 188.—**Valves for Steam and Water**—A Buenos Aires machinery house, prices f.o.b. New York; also samples if possible.

No. 189.—**Rubber Irrigation Hose, Plain and Armored**—A Buenos Aires machinery house, prices f.o.b. New York; samples if possible.

No. 191.—**Packing**—A Buenos Aires machinery house, prices f.o.b. New York; samples if possible.

No. 194.—**Entomological Supplies**—A party in Vladivostok, Siberia, wishes 100,000 entomological pins of various sizes and 100 square sizes. Further particulars on application.

No. 195.—**Tin-Plate**—A party in Irkutsk, Siberia.

No. 198.—**Asbestos**—A Lancashire correspondent wishes crude asbestos fibre.

No. 196.—**Any Canadian Product**—An importer at Ghent, Belgium.

No. 199.—**Any Canadian Product**—A London firm has export field in Mediterranean countries.

No. 200.—**Canned Goods, Boots**—A Belgian correspondent.

No. 202.—**Canned Fruit**—A Yorkshire firm of general produce merchants want entire output of Canadian firm.

No. 207.—**Any Canadian Product**—A Canadian business man travelling in Asia, India and South Africa wishes to represent a group of four or five important Canadian manufacturers of different lines.

No. 251.—**Canadian Chemicals, Leather, etc.**—Correspondent at Antwerp.

No. 254.—**Opal Glass Bottles**—A London firm of chemical manufacturers are desirous of getting in touch with Canadian manufacturers.

No. 255.—**Casein**—The Manchester branch of a French firm.

No. 257.—**Fish, Canned Salmon, Fruits and Vegetables**—A British company trading in countries bordering on the Eastern Mediterranean.

No. 263.—**Steel Wire Rods**—A Cardiff wire rope manufacturer wishes high carbon steel wire rods.

No. 264.—**Canned Meats**—A Bristol firm.

No. 288.—**Wire Nails**—Leeds firm make contracts of from 250 to 500 tons.

No. 289.—**Wire Rods**—A Warrington firm, who use 20 to 30 tons of the above in coil, and up to 200 or 300 tons monthly of straight lengths, and bars up to about 6 inch diameter.

No. 291.—**Wire Rods**—Warrington firm will be in the market for 200 tons mild steel rods, No. 6 S.W.g. in coils not exceeding 36 inch outside diameter.

No. 293.—**Linseed Cake**—A Hull firm.

No. 294.—**Hot-water Heating Boilers and Radiators**—A Liverpool firm who uses large quantities of the above.

No. 295.—**Linseed Cake and Cattle-feeding Stuffs**—A Liverpool firm.

No. 296.—**Canned Salmon and Canned Meats**—A Liverpool firm.

No. 297.—**Condensed Milk**—A Liverpool firm.

No. 300.—**Starch Powder, Milk Powder**—A Liverpool firm.

No. 302.—**Galvanized Fencing Wire, Galvanized Barb Wire and Wire Nails**—A Leeds firm is open to buy in 25 to 50 ton lots.

No. 303.—**Pulpboard and Strawboard**—A Leeds firm.

No. 306.—**Bitumen**—A Durban firm wants quotations on 100 ton lots of bitumen 98 per cent. pure, shipped in drums or casks of 400 or 500 pounds.

No. 307.—**Refined Coal Tar or Blast Furnace Tar**—An engineering firm of Durban asks for particulars.

No. 308.—**Asbestos Sheet**—A South African firm asks for samples, prices and literature of all kinds.

No. 310.—**Baling Wire**—A Pretoria firm of wholesale merchants asks for samples and prices, with information as to quantities per reel.

No. 311.—**Electrical Material**—A Durban firm asks for catalogues, price lists and samples of all kinds.

No. 312.—**White Lead**—A Durban firm asks for quotations.

No. 314.—**Electrical Goods, Iron and Steel, Piping, Wire, Machinery**—An Orange Free State firm wants catalogues and price lists on all lines.

No. 323.—**Any Canadian Product**—A Durban firm of manufacturers' agents request immediate correspondence.

No. 327.—**Fertilizers, Disinfectants and Sprays**—A Durban firm asks for samples, prices and correspondence.

No. 328.—**Any Canadian Product**—A leading South African firm want catologues and price lists.

No. 330.—**Tools, Wire**—A wholesale firm in Durban asks for catalogues and price lists, with samples of the wire.

No. 934.—**Pharmaceutical Products, Leather, Soap, Tin, Boots, Nails.**—An agent knowing the Balkan States trade thoroughly, having office in Paris.

No. 336.—**Canned Meats, Canned Fish, Canned Vegetables, Canned Fruits, Preserves**—A Belgian commission merchant.

British Columbia Business News

A Summary of Recent Metallurgical and Chemical Statistics and a Review of New Business Prospects on the Western Coast

By W. H. Hill, Vancouver, B. C.

THE estimated value of the mineral production in British Columbia during the year 1918 is placed at $41,083,083, which is $4,072,701 more than for 1917, of an equivalent increase of approximately 11 per cent. The recovery of placer gold, obtained chiefly in the Cariboo and Cassiar districts, is estimated at $300,000; while the estimated production of lode gold is figured at $3,250,895, which shows an increase of 37 per cent. over the year 1917. The silver production during the year 1918 is estimated to have been about 2,886,861 ounces, valued at $2,601,120. Lead and copper show an increase in quantity, but, owing to a lower market selling price of these minerals, there is a natural decrease in value. The estimated copper production, according to districts, is as follows: Skeena division, 30,925,928 pounds; Southern Coast district, 19,470,760 pounds; Boundary-Yale district, 10,324,922 pounds; Trail Creek division, 2,043,560 pounds; Omineca district, 562,000 pounds; all others, 59,777 pounds, making up the gross total of 63,387,010 pounds. The year's copper production promises to prove the second largest in the history of copper mining in British Columbia during the past twenty-five years. Copper takes second place to gold in representation of value of any mineral produced in this Province. The importance of the copper resources in British Columbia to the British Empire cannot be too highly appreciated, considering it has the three largest copper mines in the Empire, with the two largest concentrating mills and the three largest copper smelters. The output of zinc is estimated at 36,149,894 pounds, Fort Steele contributing about 22,000,000 pounds; Slocan, 13,601,954 pounds; while Omineca and Ainsworth produced the balance. The total estimated production of coal during 1918 amounted to 2,572,811 long tons, of which 280,743 tons were made into coke.

The Vancouver Chamber of Mines have prepared plans for an International Mining Convention to take place in this city on March 17, 18 and 19. The programme will include every class of mining, from the prospector's to the geologist's interests. Numerous exhibits of ores, machinery, models, as well as demonstrations of methods and operations carried on in the mining world will be shown. During the past year the local Chamber of Mines has made considerable progress in growth of membership, and has widely extended its sphere of influence. For this year, during the winter session, a series of lectures has been arranged. The first of these was given on January 7th by Professor J. M. Turnbull, his subject being "Copper Smelting"; then on January 13th, Dr. W. L. Uglow, of the University of British Columbia, lectured on "Platinium"; and on January 17th Dr. Hodge, Professor of Geology at the University of British Columbia, gave a lecture on "Iron Ores."

The Mining Bureau of the Vancouver Board of Trade has recently passed a resolution asking the Dominion Government to establish an ore-testing plant in Vancouver. Under the present system the ore is shipped from this Province to Ottawa to be tested, with the resultant waste of much time and money.

New Industries.

In a recent statement by the Scientific and Technical Research Council the possibilities for establishing of at least two important industries in British Columbia were indicated, namely, the manufacture of denatured alcohol from the waste products of the many pulp and paper mills on the Pacific Coast by the installation of suitable recovery apparatus; the other suggested industry being the utilization of fish and fish offal as fertilizer material, for fish oil or for stock and poultry feed. These waste materials are at present destroyed or thrown into the national dump heap. Several new industries have been established around Vancouver during the past few months, which gives evidence of the departure of the Eastern capitalists from their previous short-sighted policy of starving this Province financially, with the consequent stunting of its commercial growth. The Barrett Roofing and Supply Company, of New York, have decided to erect a factory here, costing about $80,000. The company intend manufacturing patent roofings, materials and supplies. This concern is negotiating with the Granby Mining Company to secure by-products from which to manufacture their products. The site of this new factory has a frontage of 600 feet on the Fraser River near Eburne, covering an area of six acres. As the British Columbia Electric Railway runs near this property, it will be amply supplied with rail and water facilities for the output of the factory.

L'Air Liquide Societe, of Montreal, will build in Vancouver, in the near future, a factory for the manufacturing of liquid air, calcium carbide and acetylene on a large scale. One department of the factory will be devoted to a technical school for the education and training of men in the use of liquid air and the oxy-acetylene processes. The first unit of this factory is to cost about $25,000 for the building, and the machinery will cost over $50,000.

Plans are being prepared for the B.C. Sugar Refining Company for a large extension to the receiving warehouse in order to improve the facilities for the movement and unloading of the sugar boats in and out of the harbor.

Mining Developments.

The discovery of an extensive deposit of Alunite on the Kyoquot Sound is reported. This deposit is said to be the fourth largest in the world, and should be of great value to the farmers of this Province, who are paying high prices for commercial fertilizers. It is claimed that this material is rich in potash, aluminium, sodium and silica. A company has been formed by Seattle interests, under the style of The Alunite Products Company. They intend to erect a plant at Kyuquot Sound that will be capable of producing 500 tons daily.

Considerable interest is being created by the discovery of gold quartz on the Porcupine Mountain, near Barkerville. This prospect consists of two veins, 300 feet apart, one being 28 feet wide and the other 14 feet wide. The Department of Mines assays have shown values of $61.50 in gold per ton.

It is announced by the Vancouver office of the Canadian Collieries, Limited, that plans are being prepared for opening up of some new mines on Vancouver Island and generally extending the company's operations.

The purchasing of platinium by the local assay office of the Department of Mines has been discontinued since December 31st, 1918, but the assaying of platinium bearing ores and sands will be continued.

A surprising lack of interest in the tungsten deposits of this Province is shown at present, considering the value of this mineral for use in steel manufacture. There is no doubt that there are vast possibilities contained on the Hardscrabble Creek, in the vicinity of Barkerville, and the whole of the Cariboo tungsten district. The deposits already located in these sections run parallel to the highly auriferous sulphide ore bodies for about fifteen miles. These scheelite ore deposits are of an excellent grade, and are particularly free from objectional impurities, from the standpoint of the steel manufacturer.

Test shipments of ore from the new Hazelton Gold-Cobalt Mines, Limited, show an assay of 1.40 per cent. molybdenite, 1.8 molybdic oxide, 1.54 cobalt, 8.90 arsenic, and gold 1.48 ounces, making a total value of over $105 per ton.

The oil developments of the Burnaby district are proceeding very quietly. A flow is expected in the early spring.

The Canadian Pacific section of the Society of Chemical Industry held their first monthly meeting this year at the Vancouver Chamber of Mines on January 20th, when Mr. W. S. Barwick, of the Vancouver Engineering Works, gave a very interesting and instructive paper on "Ferro-Alloys and Their Uses in Steel Making."

New Incorporations.

The following companies were incorporated in British Columbia during the past two months: Aberdeen Mines, Limited (N.P.L.), Vancouver; capital, $200,000; acquiring ten mineral claims in the Nicola mining division, B.C. The Chowns Chemical Co., Limited, Vancouver; capital, $10,000; chemists and druggists. Index Molybdenite Mining Co., Limited (N.P.L.), Vancouver; capital, $500,000. Engineering Corporation, Limited, Vancouver; capital, $25,000, consulting general engineers. The producer Co., Limited, Jedway, B.C., capital, $75,000; mining. Coal Creek Mining and Developing Co., Britannia Beach, B.C.; capital, $1,000,000. Wall ace Mountain Mines, Limited (private), Penticton, B.C.; capital, $50,000. Redonda Iron and Copper Co., Limited (N.P.L.), Vancouver; capital, $100,000. Mountain Chief Mining Co., Limited, Nelson, B.C.; capital, $50,000. British Columbia Breweries, 1918, Limited, Vancouver; capital $300,000. Canadian Johns-Manville Co., Limited, Vancouver, licensed in British Columbia; capital, $2,500,000; asbestos and magnesia products.

NEW YORK LETTER.

Special Correspondence to the Canadian Chemical Journal.

At the annual meeting of the stockholders of the National Aniline & Chemical Company, held on Feb. 17th, a number of important changes in the personnel of the Board of Directors of this company occurred. J. F. Schoellkopf, C. P. Hugo Schoellkopf and Dr. J. F. Schoellkopf, Jr., withdrew from all active duties in connection with the concern, in order to give their entire attention to other business connections in the Niagara Falls district. Mr. F. M. Peters, of Chicago, long connected with the American Cotton Oil Co., was elected a director. The present board of directors includes:—

H. H. S. Handy, of the Semet-Solvay Ca., Syracuse, N.Y., W. N. McIlvray, Vice-President of The Barrett Company, New York, Wm. Beckers, Brooklyn, N. Y., former owner of the Beckers plant which was taken over by the National Aniline and Chemical Company at its organization, L. C. Jones, chemist with the Semet-Solvay Co., Syracuse, N. Y., C. S. Lutkins, Ass't. Treasurer of the General Chemical Co., New York, Henry Wigglesworth of the General Chemical Company, Dr. William J. Matheson of the same company, R. A. Shaw, formerly with the Cassella Color Company, of New York, T. M. Rianhard of The Barrett Company, New York, I. F. Stone, of the original National Aniline and Chemical Co., prior to the consolidation, Dr. R. C. Taggeshall of the General Chemical Company, O. F. Weber of New York, F. M. Peters, the new director referred to above and Eugene Meyer, a New York financier prominently connected with the reorganization of the company.

Dyestuffs.

A corporation to be known as the Chemical Foundation, composed of certain persons identified with some of the larger dyestuff manufacturers, has been formed to take over the enemy patents relating to dyestuff manufacture. These patents are now in the hands of the Alien Property Custodian, having been taken over from their German owners during the war. The new corporation will not make any dyes. It will license manufacturers to use the patents, and prevent any one concern getting a monopoly. This action will enable a large number of the more modern dyes in greatest demand to be supplied to American trade from American sources. The technical details of making many of these dyes have already been worked out in this country, and now that proper steps have been taken to legalize the manufacture of these particular products, a steady supply ought to be assured.

It is expected that a delegation representing important dyestuff manufacturing interests will approach the President during his trip home to emphasise the importance of adequate protection to the new American dyestuff industry. Whether the legislation asked for will take the form of a high tariff or of import licenses is still a matter for discussion, but some protection is most desirable. During the few years since the commencement of the War the dye manufacturing industry of this country has advanced to a position at least comparable with that which it took Germany almost half a century to attain. Competent authorities are very pessimistic as to the ability of the United States to preserve the results of all this effort if adequate protection is not provided. Large German interests are preparing already to attempt to dominate the world's dyestuff trade if not from Germany, from Switzerland, Holland and other neutral countries.

New Uses for Breweries.

All over the country breweries and distilleries are being "reformed" and converted to other lines of manufacture. Some of the breweries are taking up the manufacture of food products, maltose, condensed milk, etc. The Huntington Chemical Company, Huntington, Ind., have taken over a large brewery at that point and will make alkaloids, acetates, phosgene and other chemical products. It is reported that hydrogenated oil products are to be made at some of the large distilleries owned by the Distillers Securities Corporation. Many of the breweries, however, are "sitting tight" expecting that beer will come back and are busying themselves at present with producing "near beer" since the ban on that line of manufacture has been lifted by the Food Administration.

Personal.

Dr. Jokichi Takamine, of the Takamine Laboratories, New York, has sailed for Japan on a business trip.

Mr. J. F. Queeny of the Mosanto Chemical Works, St. Louis, is making a trip to Europe to study chemical trade conditions.

Dr. Charles F. Lindsay, formerly with the Imperial Munitions Board of Canada, and more recently with the British War Mission in New York, has resumed his work as a consulting engineer and is located at Bridgeport, Conn.

Major Adrian Nagelvoort, C. W. S., has received his discharge from the army and has taken a technical position with Arnold Hoffman & Co., large manufacturers of alkali, etc., with headquarters at Providence, R. I. During his service in the army Major Nagelvoort was in charge of the various plants of the Chemical Warfare Service, at Niagara Falls, N. Y.

Lieut. A. Klipstein, Jr., of the U.S.A. (Infantry), has received his discharge from the army and is back with A. Klipstein & Co., New York City.

Captain Washburn, C. W. S., has received his discharge from the army and has resumed his former connection with the Titan Company, New York, and is living at the Chemists' Club.

Mr. Chas. F. McKenna, Jr., who has been on the staff of the Government smokeless powder plant in Tennessee, the largest plant of the kind ever constructed, has returned to civilian life and has resumed his former connection with the Chemical Catalog Company, Inc., New York.

Mr. Beach, of Beach, Bush and Gent, New York, who are selling agents for the Great Western Electro-Chemical Co., Pittsburg, Cal., and have other important connection in the chemical industry, is in Europe investigating chemical trade conditions.

Industrial.

Dye Products & Chemical Company, New York, has enlarged its factory site at Newark, N. J., and is increasing its manufacturing facilities.

A severe explosion at the plant of the American Aniline Products, at Nyack, N. Y., a few miles above New York City, on the west bank of the Hudson, killed four workmen, injured a number of others and caused a loss of over $200,000. The explosion originated in a drying chamber. The company is an important one, employing over 300 people and making a wide line of colors.

An explosion in the laboratory of Colgate & Co., soap makers, Jersey City, N. J., blew Dr. Geo. Pierce out of a window and caused his death. An assistant, Walter Switzer, was also killed and several others badly injured. The explosion was caused by a leakage of ether during an extraction with that solvent. A bad fire followed the explosion, but was soon gotten under control. Dr. Pierce was a resident of Upper Montclair, N. J., and was well known in local chemical circles.

Wright Chemical Company, New York, manufacturers of dyestuffs, especially sulphur colors, are enlarging their plant at Springfield, N. J.

Lever Bros., Cambridge, Mass., are adding to their plant, putting up a new building for the manufacture of glycerine.

A fire at the Rollin Chemical Co., Charleston, W. Va., resulting from the explosion of a still, caused a loss of $250,000 early this month. The company manufactures barium products, chlorbenzol, etc.

It is stated that the $75,000,000 smokeless powder plant erected by the government at Nitro, near Charleston, W. Va., is to be dismantled and sold to private parties. Lieut.-Col. D. K. Shurtleff is in charge of the disposal of the material.

It is expected that the Dupont Company will re-open the munitions plant at Hoepwell, Va., using it to manufacture chemical products. This will employ several thousand employees. A very considerable town has grown up around this plant since 1914.

Feb. 24, 1919. F. M. TURNER, Jr.

GENERAL INDUSTRIAL AND CONSTRUCTION NEWS.

Alberta.

At Redcliffe, Alta., the Dominion Glass Co. are installing new machinery in their plant.

British Columbia.

L'Air Liquide Society have let a general contract for a $25,000 branch factory at Vancouver, B.C.

Manitoba.

$12,000 factories will be erected by the Coca Cola Co. of Winnipeg, Man., at Regina, Moose Jaw, Saskatoon, Lethbridge and Vancouver.

The Winnipeg city council propose to build a civic pulp and paper mill to cost $3,000,000.

Ontario.

The feldspar mines in Frontenac County have practically closed down until spring.

The factory of the Wolverine Brass Co., Chatham, has been purchased by the Denby Motor Truck Company.

The Oak Tire & Rubber Company, Ltd., will enlarge their factory at Oakville by the addition of another story.

The Port Dover Canning Company is planning a two-story cement block addition to their canning factory to cost $25,000.

Sir John Gibson has confirmed the report that negotiations for the purchase of the National Steel Car Company at Hamilton by the American Car & Foundry Company were in progress.

The Riordon Pulp & Paper Company, Merritton, have issued $4,000,000 of 6 per cent. ten-year mortgage bonds for the construction of a new 30,000-ton bleached sulphite mill on Lake Temiskaming, Ontario, for the Kipawa Company, a subsidiary of the Riordon Company.

The Wm. Kennedy & Sons, Ltd., have erected an extension to their already large iron and steel plant at Owen Sound. The new building is of concrete, stone, brick and steel construction, 200 feet x 46 feet, the walls being about 30 feet high. It is to be equipped with two cupolas for melting iron, and an elevator for carrying pig and scrap iron and coke to storage bins, situated some 14 feet from the ground. This company in conjunction with some others, lately took over the property of the Owen Sound Iron Works and are operating there on the construction of ship machinery, boiler works, cement mill machinery, etc.

The McKenzie Machinery Co. are now occupying the old Bronze Company Building, at Preston, and are installing new machinery.

The McKinnon Industries at St. Catharines is returning to the manufacture of its former products, including malleable iron castings, drop forgings, sheet metal work, and electric welded products.

The Canada Wire and Cable Co., Ltd., Toronto, are installing machinery for manufacturing a full line of steel wire rope in their plant at Leaside.

The Andrews Wire Co. plans erection of extension to their factory at Watford.

The plant and buildings of A. Blair Company's Tile Plant, Woodstock, were destroyed by fire with a loss of $30,000.

Plans and specifications are being prepared by the Canadian Iron Corporation for the remodelling of their pipe foundry at Fort William, at an estimated cost of $125,000.

A plate mill, with a capacity of 10,000 to 12,000 tons per month is included in the plans for a peace re-adjustment basis of the Dominion Foundries and Steel Company at Hamilton. Definite decision has not been made as yet, however, though the erection of a pattern building, costing $75,000, is now under way.

The Matthews Gravity Carrier Company, of Toronto, are opening their new factory at Port Hope, at an early date.

The Wentworth Mineral Water Co. are preparing plans for an addition to their plant at Hamilton, to cost $15,000.

The Mercury Mills, Limited, Hamilton, plan to make an addition to their factory.

A $2,000,000 linen industry is to be established in Western Ontario, using the flax acreage in that part of the province. London is presenting its claims for the location of the factory. The establishment of such an industry is said to be the immediate result of the Government's policy in giving a bounty for the spinning of textiles from flax grown in Canada.

The plant of the British Forgings, Limited, Toronto, which operated for war purposes under the authority of the Imperial Munitions Board, is now closed and the works and machinery are to be disposed of by private negotiation.

A deputation which went to Ottawa a few days ago from Port Arthur obtained a promise from the Dominion Government that an investigation would be made to determine the value of the porcelain clay and silica sand deposits north of Fort William and Port Arthur.

According to a cablegram received by the British Trade Commissioners, G. T. Milne at Montreal, and F. W. Field, at Toronto, from the Department of Overseas Trade, the following headings, in addition to others not immediately concerned with industrial chemistry, have been removed from the list of articles prohibited from exportation from the United Kingdom, namely: Cable lead sheethead, carbon, lead compounds except white lead, linen rags and waste, ramie fibre, paint except gold paint, cotton rags, hemp waste, tin plate, anchors, barometers, caramel, celluloid ordinary or non-inflamable, dextrine, gas meters, ginger, meat extract, potato flour, saccharine, starch, wine, and zinc.

The Ottawa City Board of Control propose to construct laboratories at the Royal Ottawa Sanatorium.

Nova Scotia.

The Havelock Bottling Co. will extend and remodel their plant at Sydney, including the installation of new machinery.

Quebec.

The Canadian Engineering Standards Association has recently been incorporated with head office at Montreal. The chief objects of the Association are: To co-ordinate the efforts of producers and users for the improvement and standardization of engineering materials; and to prepare and promote the general adoption of standards in connection with engineering structures, materials and other matters and things, and from time to time to revise, alter and amend the same. The following distinguished professional men are listed as the incorporators: Sir John Kennedy, Dr. Robert Ruttan, Dr. John Bonsall Porter, Richard John Durley and Henry Hague Vaughan, all of Montreal. The operations of the corporation are to be carried on without share capital and with the head office at Montreal.

The statement of the Asbestos Corporation of Canada for 1918 shows that profits from operations, after providing for government taxes, added to interest from investments totalled $1,253,813 against $563,069 in 1917, an increase of $690,744 or 123 per cent. over the best previous performance of the company. The year's surplus available for dividends amounted to $801,927 against $253,789 in 1917, an increase of $548,138 or 216 per cent.

The Canadian Sugar Refinery Co., Ltd., plan the erection of an extension to their plant at Montreal.

Contracts have been let for the erection of a shoe factory for the St. Hyacinthe Soft Sole Shoe Co., Ltd., at St. Hyacinthe, Que., to cost $20,000.

A sulphite mill costing $500,000 and possibly a paper mill, it is reported, will be erected by the St. Maurice Lumber Co., a subsidiary of the International Paper Co. at Three Rivers.

Saskatchewan.

A cold storage plant and abattoir to cost $40,000 is proposed for erection at Yorkton, Sask., by the Saskatchewan Co-operative Creameries, Ltd., of Regina.

An option has been secured on a 40-acre site at Regina by the Continental Oil Co., on which it is proposed to erect a plant at a cost of $1,000,000. Crude oil will be brought to the refinery from the Wyoming oil fields.

United States.

The Benzo Chemical Co., of New York, N.Y., have assigned to Aaron Palmer, assignee, and the assets are being sold by auction through A. Joseph & Co., auctioneers, 154 Nassau Street, New York.

The Transoceanic Commercial Corporation, an export concern, has been formed in the United States to represent the Distilleries Securities Corporation in foreign markets. Through this export company, a large quantity of the 100 million gallons of beverages and non-beverage distilled spirits at present stored in the warehouses of the United States will be exported to foreign shores. The approaching of national prohibition has made it imperative that means be taken to dispose of the surplus quantity abroad.

The amendment to the Rivers and Harbors Bill now before the United States Congress, authorizing the Joint High Commission to develop the St. Lawrence River between Montreal and Lake Ontario for ocean-going ships, has not been supported by the New York State Assembly, who have passed a resolution of protest to the amendment.

PERSONALS.

Colonel C. H. Mitchell, C.B., C.M.G., D.S.O., chief of the Intelligence Staff of the allied armies in Europe, and one of the most active graduates of the School of Science, Toronto, has been appointed Dean of the Faculty of Applied Science and Engineering, University of Toronto, to succeed Dean Ellis, who is retiring.

Dr. F. B. Jewett, chief engineer of the Western Electrical Company, New York, and director of the research department of the Bell Telephone System, addressed the Royal Canadian Institute, Toronto, Saturday evening, February 8th, on "The Need of Research and Trained Workers."

Corporal H. D. Cameron, Canadian Field Artillery, who has seen three years' service in France and Belgium, has returned to his duties with the Nichols Chemical Company, Toronto, where he found his desk, that he vacated three years ago to enlist, awaiting him. Corporal Cameron was gassed and wounded.

Mr. G. C. Benson, recently of Nobel, Ont., has accepted a position with the National Carbide Company of Toronto as research chemist.

In order to recuperate his health, Mr. Robert S. Perry has resigned as Presidentand Director of The Kalbfleisch Corporation of New York, and is leaving for his plantation at Cove Spring, Ga. Mr. Franklin H. Kalbfleisch, Chairman of the Board of the corporation succeeds him as President.

Mr. W. W. E. Ross, who has but recently returned from England, where he has been working with Professor J. C. McLennan, F.R.S., O.B.E., in connection with scientific research work being carried on by the British Admiralty, has accepted a studentship from the Advisory Research Council, Ottawa, and will make his investigations under the direction of Dr. Burton in the Department of Physics, University of Toronto.

Miss Nettie Robinson, who has been with the Nichols Chemical Company for over fourteen years, in charge of the office at the Toronto warehouse, has taken up her residence at Regina, Sask. Miss Robinson had a reputation as perhaps the best business woman in all Canada, her services having been frequently sought after by many large concerns and institutions. She was well known to the chemical trade throughout the Dominion.

A wide circle of friends will learn with deep regret of the death of the late George E. Drummond, of the well-known iron and steel firm of Drummond, McCall, Company, Montreal, Quebec. Mr. Drummond was a man of great ability and wide knowledge of public affairs, and was esteemed for his general disposition as well as his knowledge of industrial conditions in Canada. He was a brother of the late Dr. Drummond, author of The Habitant.

Lieutenant G. T. Lyall, formerly an engineer with the Toronto Power Company at Niagara Falls, has been awarded the Victoria Cross for exceptional bravery. He enlisted over three years ago at St. Catharines, Ont., and was born in England, where his father was a Lancashire clergyman.

Mr. F. P. Gavin, B.A., Principal of the Windsor Collegiate Institute and Technical Day and Night Schools, has been appointed to the staff of the Director of Technical Education of Ontario. Mr. Gavin is an honor graduate of Queen's University, Kingston, with specialist standing in science. Under his direction, the Windsor Board of Education was one of the first in Ontario to establish classes under the Industrial Education Act.

Mr. K. S. MacLachlan, B.A.Sc., who has been with the Imperial Munitions Board as Supervisor of Production and Distribution, has been appointed by Hon. Dr. H. J. Cody, Minister of Education, Ontario, to the staff of the Director of Technical Education. Mr. MacLachlan is an honor graduate in chemical engineering of Toronto University. He has been engaged in the metallurgical industry at Welland and in explosives in New Jersey, and was also on the technical staff of the British Chemical Company at Trenton, Ont.

BRITISH DYE COMMISSION.

The Board of Trade has appointed a committee to determine the colors and intermediates that may be imported into the United Kingdom. The problem is difficult, and the first requirement is that the dye industry must be placed on such a footing that it will be enabled to supply a wide range of fine colors at as low a price as any other country.—The Dyer.

RECENT INCORPORATIONS.

Montreal.—R. Percy Sims, Limited. J. A. Hutcheson, Solicitor, Brockville, Ontario. Capital $20,000. Consulting Eingineering business.

Montreal.—N. E. McClelland & Co., Ltd. F. H. Markey, Solicitor, Montreal. Capital $20.000. Mechanical and Electrical Engineers, naval architects, commission agents.

Montreal.—Asbestos Coverings and Lubricants, Limited. Capital $100,000. To work mines, quarries, mineral and other deposits.

Montreal.—Edward Thorne & Co., Ltd., Quebec. Fitch and Bernstein. Capital $100,000. Chemicals, drugs, dyeware, and oils.

Ingersoll, Ont.—Ingersoll File Co., Ltd. Solicitor, J. S. Ross, Toronto, Ont. Capital $500,000. Manganese, copper, iron, steel, coke, gas.

Guelph, Ont.—Shinn Manufacturing Co. of Canada, Ltd. Solicitor, A. L. Reid, Toronto, Ont. Capital, $50,000. Metals, wires, cables.

Hamilton, Ont.—The Gerrard Co., Ltd. A. L. Reid, Solicitor. Capital $400,000. Iron and steel products, hardware.

Toronto.—J. P. Dwyer Molybdenite, Ltd. Capital $350,000. Alexander McCrae, Engineer, to prospect for, develop and work molybdenite and other mines.

Toronto, Ont.—Bastian Brothers, Ltd. Solicitor, J. A. McIntosh, Toronto. Capital $50,000. Metal, cloth and celluloid.

Toronto, Ont.—Marine Products. E. W. Wright, Solicitor, Toronto. Capital $500,000. Fishers and dealers in fertilizers, oils, fats, glycerine.

Winnipeg.—Standard Sales, Ltd., (Manitoba) A. S. Matheson, Solicitor, Edmonton, Alta. Capital $30,000. Commission merchants.

BOOKS REVIEWED AND CATALOGUES RECEIVED.

SCIENTIFIC MATERIALS BLUE BOOK—1919.

Scientific Materials Company, Pittsburgh, Pa., U.S.A., pp. 659. Free to Heads of Laboratories; all others $2.00.

Under some 5,970 general classifications everything used in a modern laboratory is listed. Materials are arranged alphabetically and are practically all illustrated. Current prices are given, these, of course, being subject to change as markets vary. It is interesting to note that enemy products have been eliminated, and the spell which held so many of our scientific men when on the market for apparatus has been thoroughly destroyed. A very complete list of chemicals supplements the apparatus. The details of size and make-up have been given every attention, and the catalogue may be highly recommended as one which every laboratory in the United States and Canada should have as a valuable reference book.

Insuring the To-morrow of the American Chemical Industry.

(*The Literary Digest, New York*, 1919, *pp.* 39.)

What is said on behalf of the chemical industries of the United States is equally true in various ways of the chemical industries of all the great allied nations. The message of the book is important and exceedingly timely. The movements for publicity now gaining ground as part of the aim and program of chemists everywhere are voiced in the preface in the following sentence: "The leaders of the American chemical industry will come out of the laboratory and out of the factory and talk to the thinking public in the magazines and newspapers of America." This is a book which every chemist should urge upon his circle of friends. It will tell them more about his work during

the last four years than they are likely to know through conversation. It is a weapon capable of making great inroads upon that stolid ignorance which exists in high places regarding the possibilities of industrial chemistry.

The little book is not heavy. Anyone could read it in half an hour. It is not entirely suitable for Canadian consumption, inasmuch as it does not touch upon developments other than those in the United States. As an instrument for stimulating a popular interest in the mind of the average American citizen in facts relating to the status of the chemical industries of the United States, the effort is ideal. For Canadians, the publication should suggest some very necessary propaganda work of a similar nature relating to Canadian activities and the possibilities of Canadian chemical industries.

Recent Technical Reports.

(1) The Production of Ferromanganese in Blast Furnaces. P. H. Royster, Bureau of Mines, Washington, D.C. Data from 18 furnaces is given with full report.

(2) The Preparation of Crucible Graphite. Geo. D. Dub, Bureau of Mines, Washington, D.C.

(3 Problems Involved in the Concentration and Utilization of Domestic Low-grade Manganese Ore. E. Newton, Bureau of Mines, Washington, D.C.

Firms' Catalogues.

Stephen-Aylsworth Co., Inc., 253 Broadway, New York. Chemical apparatus and special machinery. Showing various lines of evaporators, kettles, stills, coils, washers and chemical equipment.

Griscorn-Russell Co., 90 West Street, New York. Bulletin No. 1110. Stratton Air Separator, designed to use centrifugal force as a means of separating water from air.

Volta Manufacturing Co., Welland, Ont. A calendar designed to illustrate electric furnace regulators, electrode winches, clamps, and hoists. A most serviceable office decoration.

Mathews Gravity Carrier Co., Toronto. Showing conveyors, elevators and industrial handling systems.

Chemical, Drug and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

CHEMICALS.

"Irregular" and "uncertain" sums up conditions on the chemical market perhaps as well as any expression, not only in Canada but in the United States. There are two main reasons for this, which, indeed, may be combined into one. There have been during the past month, and are to-day, two sources of supply entering into the market; the "second hands," and the established producers. As one prominent chemical man informed this Journal a few days ago, "the second hands are doing the business," but he also added that the established producers would remain "at the old stand," and prophesied that within a very short time, maybe a matter of a few days, the trade would swing back into regular channels again. Not a small amount of this second hand material is being placed on the market by the Canadian and United States Governments, or their agents, being material purchased for war purposes and now of no immediate use to the Government. The second reason, which as stated, is closely related to the second hand material proposition, is the fact that hundreds of speculators on the chemical market, who, as has been stated, "have made their pile out of war conditions, although hardly one of them knew the first thing about chemistry," have dropped out of the market, and the result has been to increase the factor of irregularity noted above. Many of the speculators were dealers, working through companies formed to meet, or rather to take advantage of, war's demands. The contracts made by any of these are now practically "null and void," and the product is offered in competition to the product of real chemical industries, which were in operation long before the war.

How are the established producers meeting the situation? Certainly not by cutting prices to undersell the second hand material. There is no real cutting of prices so far as the producers are concerned. A New York report that one of the large chemical firms in the United States was cutting prices on bleaching powder is not confirmed by a personal enquiry from one of their head officials. "Bleaching powder costs two cents a pound to produce and it won't go below that," stated a Canadian dealer a few days ago.

The future, then, of the chemical market and our chemical industries is bright. It is Hopeful, with a good-sized H. Already there is a turning back to the original dealers that promises to steadily increase, producing Regularity and Certainty throughout the whole market.

Soda Ash.—In a statement issued to the Echo, of Amherstburg, Ont., by G. S. Rutherford, Manager, Brunner, Mond, Canada, Limited, Mr. Rutherford dealt with the non-operation of their alkali plant at Amherstburg. He makes it plain that more protection should be given by the Canadian Government to the soda ash industry of Canada. A measure of protection is already given some Canadian companies. Another statement, issued by A. L. Campbell, Assistant Manager, states in part: "The construction of the plant has not been discontinued, but will be carried on until all work is completed. To accomplish this there were 384 employees on the Brunner, Mond pay roll, February 12th, 1919."

Pyrite and sulphur.—The cessation of hostilities and the abrogation of war contracts found the large consumers of pyrite and sulphur in the United States with a large supply on hand, and naturally until these reserves are absorbed the demand for new material will be greatly curtailed. One must also consider the fact that many of the acid manufacturers, especially those engaged in the manufacture of fertilizers, are not anxious at this time to enter into any new contracts for either pyrite or sulphur, anticipating that the present prices of these products will be materially lower in the course of the next few months. At the time the armistice was signed the large sulphur companies in Louisiana and Texas had large reserves of sulphur above ground, estimated at more than one million tons.

Potash.—The market is just recovering from a serious crisis developed in the potash industry in the United States. It is estimated that about 100,000 tons, gross weight, of potash salts, produced in 1918 in the United States, are still unsold. The large war prices, about $4 per unit, have been, no doubt, largely responsible for this situation. The farmers are not buying, hoping for the price to drop. Then the report that potash from Alsace was going to come in caused the market for domestic potash in the United States to disappear almost entirely, just when enquiries were beginning to come in. The Alsace scare was, however, remedied by Government action on January 25, when it was announced that no Alsation potash would be available in the United States for agricultural purposes before June, 1919, "even under the most favorable circumstances." A bill has also been drawn up, insuring the sale of domestic potash by making the purchase of a like amount of domestic potash necessary for the bringing in of any quantity of foreign potash. The Canadian fertilizer trade has been buying some potash recently.

METALS.

The British Columbia Advisory Committee for Scientific and Industrial Research have reported to the Research Council at Ottawa that the development of an iron and steel industry on the Pacific Coast was quite feasible, an opinion often expressed by pioneers in the mining and metallurgical industries of the Coast. The Advisory Committee concluded that there is room for one large plant,

provided that it is assured the entire Pacific Coast market, but the establishment of more than one plant would not be wise. The opinion has been expressed that there is not much likelihood of the iron and steel industry being developed on a large scale on the Pacific Coast.

So far as local Canadian markets go, conditions are improved in the metal market now to what they were in January. Prices have eased up a point or so. "Conditions are certainly better than they were in January," stated a Canadian dealer a few days ago, who affirmed his belief that, despite the bigness of the re-establishment problem, which affects the metal industry perhaps more than any other, the Canadian metal industries would rally, and that they were already getting on firmer ground again.

Asbestos.—Optimism undoubtedly prevails to-day in the asbestos industry in Canada. W. G. Ross, President of the Asbestos Corporation of Canada, writing in the directors' report of the Corporation for 1918, states in part: "With peace at hand, and the lifting of restrictions and embargoes on the export of asbestos to neutral countries in Europe, a field which has been closed for over four years again opens up. The reconstruction of devastated France, Belgium, and other parts of Europe, and the uses to which asbestos is now being put, should result in the continued demand for our country's materials."

OILS AND COAL TAR PRODUCTS.

At Toronto, trade in oils has been very fair during February, about the same as in January, with prices remaining at about the same level.

Cotton.—A reaction occurred in Southern Oils on the New York market on February 19th, for which threatened labor trouble was blamed, but a better explanation was the fact that speculative buyers became disappointed at the failure of the market to respond to their efforts to advance prices, and an attempt to liquidate exposed the weak technical position.

Acetanilid, C. P.	Lb.	1.00
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	.24—.27
Aspirin, in 100-lb. lots	Lb.	2.10—2.25
Alchohol, grain, bbl., duty paid	Gal.	8.75
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26°	Lb.	.12—.14
Ammonium Carbonate	Lb.	.11—.20
Ammonium Chloride	Lb.	.23—.25
Benzoic Acid	Lb.	2.00
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per ton	$30—$35
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	.05½—.06
Chloroform	Lb.	.65—.99½
China Clay, imported	Per ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	.09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.22
Hydrochloric Acid, carboys, 18°	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¾—.04½
Muriatic Acid, 18° to 22°	100 Lbs.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36° carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.38—.40
Potassium Bromide	Lb.	—.75
Potassium Nitrate, kegs	Lb.	.28—.30
Potassium Permanganate, bulk	Lb.	2.25—2.50
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	.85—1.10
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.20—.22
Sodium Benzoate	Lb.	2.50—2.75
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bichromate, bbls.	Lb.	.18—.19
Sodium Nitrite	Lb.	.18—.19
Sodium Nitrate, refined	100 Lbs.	7.75—8.50
Sodium Nitrate, crude, 95%	100 lbs.	5.25—5.75
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.35—.40
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	2.75—3.00
Sulphur, roll	100 Lbs.	4.25—4.50
Sulphuric Acid, 66° Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphide, 35°	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.90—.95
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06½
Zinc Dust	Lb.	.17—.19

Metals.

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	.—10
Brass, yellow ingots	Lb.	.15—.17
Brass, red	Lb.	.15—.20
Cobalt, metal	Lb.	—2.50
Cobalt Oxide, grey	Lb.	—1.65
Copper, casting	Lb.	—.23
Copper, electrolytic	Lb.	—.23
Iron, common, base price	100 Lbs.	—5.00
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Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
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Silver, bar (U. S. Govt. price)	Per troy oz.	—1.01⅛
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Steel, sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.20

Oils.

Motor Gosoline	Gal.	—.33
Motor Gasoline (service stations)	Gal.	—.36
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Naphtha	Gal.	—.32
Coal Oil	Gal.	—.19½
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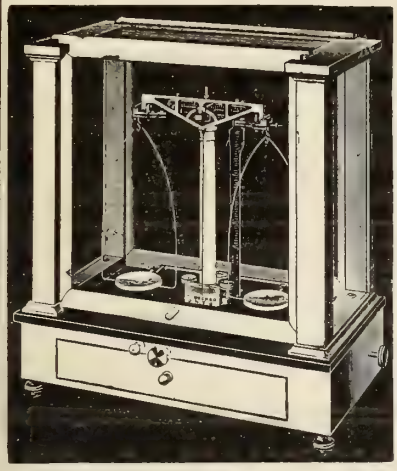

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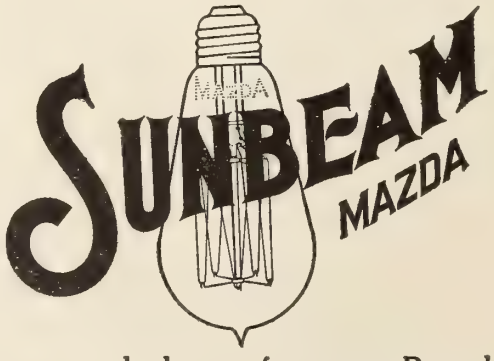

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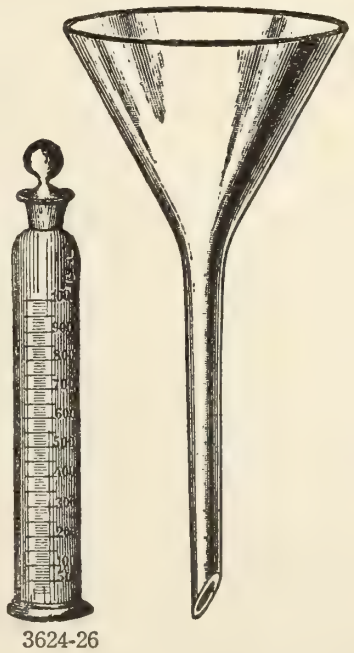

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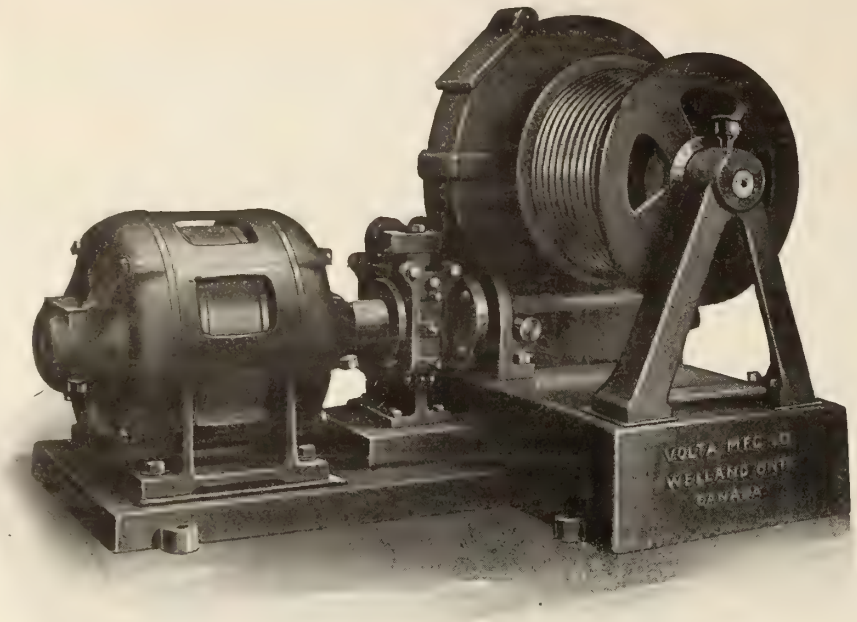

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Pfaudler Utility Pot

SPECIFICATIONS

Capacity—26 gallons.

Size—Diameter inner pot 18 inches. Depth inner pot 25 inches. Total height 45 inches with legs. Floor space 4 square feet.

Material—Open hearth sheet steel, three-sixteenths of an inch thick.

Lining—All interior surfaces in contact with contents lined with PFAUDLER Acid-Resistant, Glass Enamel.

Connections—One 2 inch standard flanged nozzle. Two 3 inch standard flanged nozzles. Jacket connections—1 inch oil inlet and 1 inch drain.

Handles—3 handles welded to inner pot to facilitate its removal.

Top Head—Secured to pot by 12 C-clamps. Joint made with asbestos gasket.

Jacket—Sealed with asbestos gasket and secured to inner pot with 12 bolts.

Legs—Three-eighths inch steel 2½ inches wide of suitable length.

What the Chief Chemist Said:

"It has proven invaluable in our work, both because it has given splendid satisfaction with acid solutions (Sulphuric, Nitric and Acetic in various concentrations), and because we have found it so handy and convenient for so many different operations. I do not see how any manufacturing chemist or pharmacist is content to get along without this compact, efficient, versatile, economical outfit."

This is what Dr. Schultz, chief chemist of the Rochester Photo-Chemical Works, says about the PFAUDLER, Acid Enameled, Utility Pot shown in the picture after over a year's experience with it.

He also told us (for publication) how he was able to use this outfit for Distilling, Evaporating, Crystalizing, Dissolving and Mixing and for carrying out various reactions requiring an absolutely acid-resistant container.

Inasmuch as the Rochester Photo-Chemical Works is a real synthetic chemical plant, where they build up exceedingly complex organic compounds from raw material, carrying out in the process many major chemical operations, such as electrolytic, synthetic condensation, their experience should be of deep interest to everyone interested in manufacturing chemistry.

We have published the Doctor's observations in the form of an attractive little folder entitled, "What the Chief Chemist Said," and will be glad to send a copy to any Chemist who will send us his name and address. This without any obligation whatsoever. Address the Rochester Office.

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Ontario abounds in waterpower, now in many places being transformed into hydro-electric energy for manufacturing, mining and metallurgical purposes. Many localities are capable of becoming industrial centres for the transformation of raw materials into finished products by electro-chemical and electro-metallurgical processes. A striking example is the area contiguous to the great cataract of Niagara.

For information in regard to ores, minerals and mineral products, and for reports, maps, list of publications, etc., apply to

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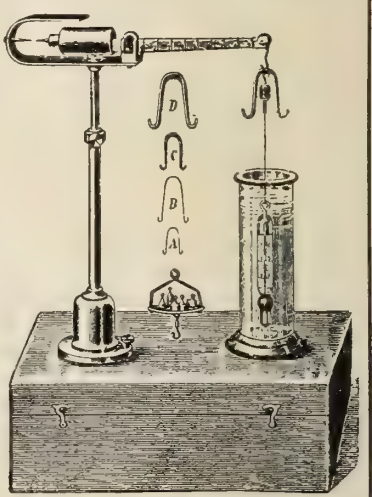

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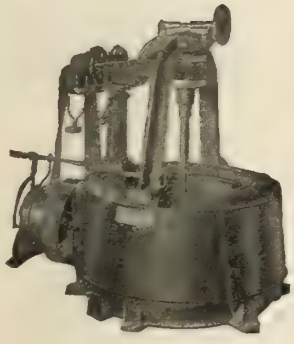

Tolhurst Centrifugals

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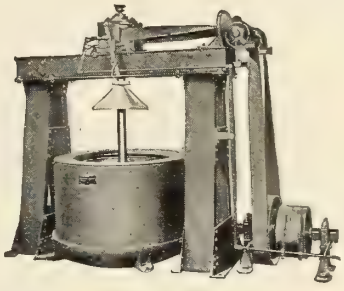

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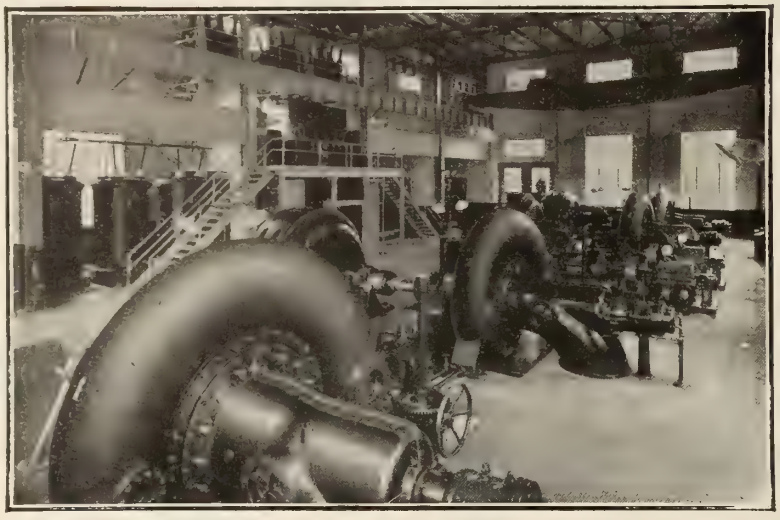

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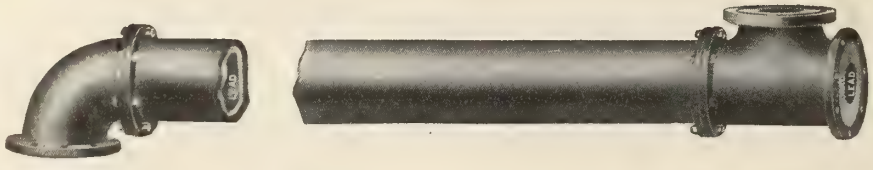

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No valves to clog
No moving parts in the well
Only two pipes in the well
Compressor can be half a mile away or more
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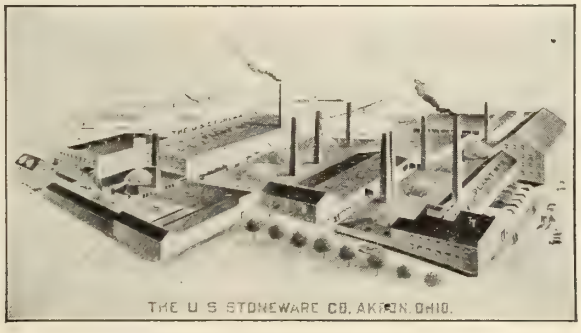
"The celebrated impervious body of the U.S. Stoneware Co.'s Stoneware is due to the exclusive clay of which it is made"

Acid-Proof Chemical Stoneware and Bricks



America's Greatest Acid-Proof Chemical Stoneware Potteries.

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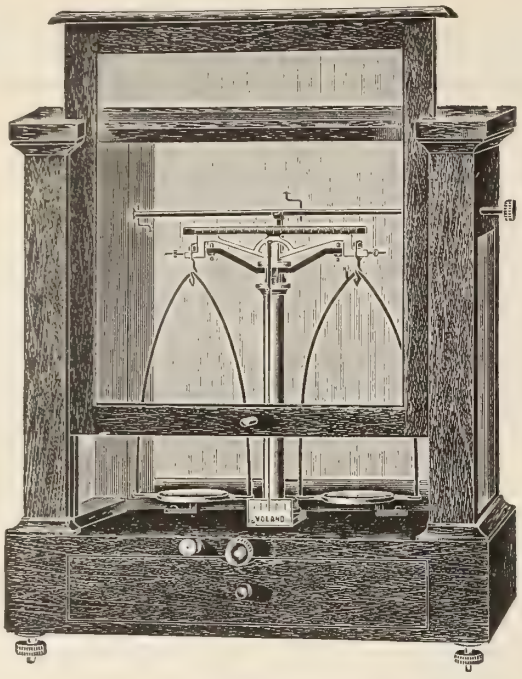

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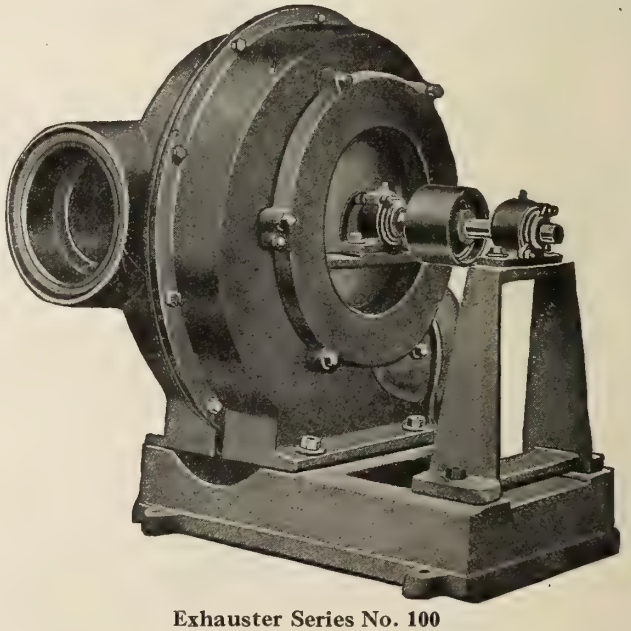

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Our clay and method of manufacture is NOT the same as used by others in our district

Our ware is NOT the cheapest, nor is it fancy, but it is GUARANTEED to be acid-proof, free from defects, not to leak or sweat, and to be perfectly satisfactory in every respect.

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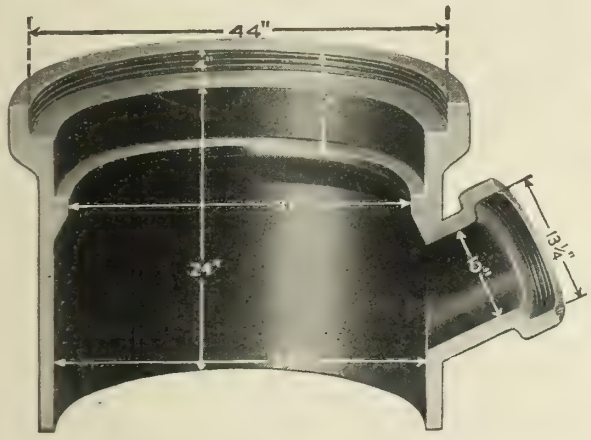

ACID-PROOF TOWER BOTTOM SECTION
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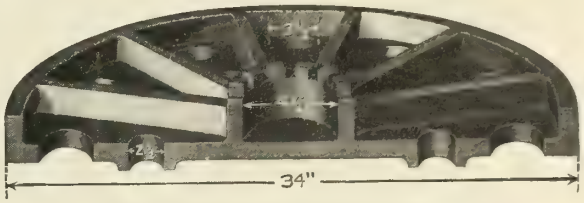

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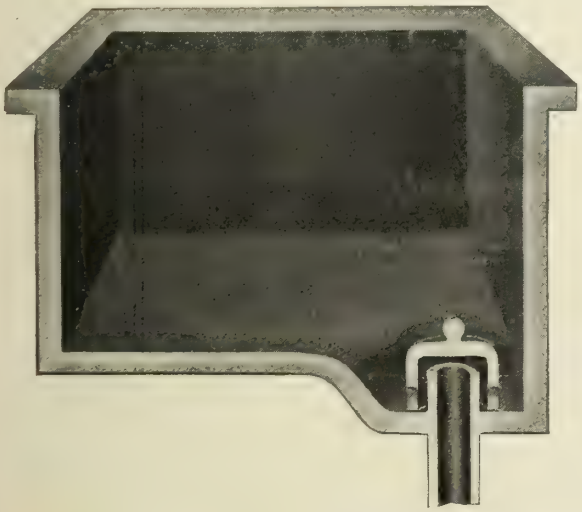

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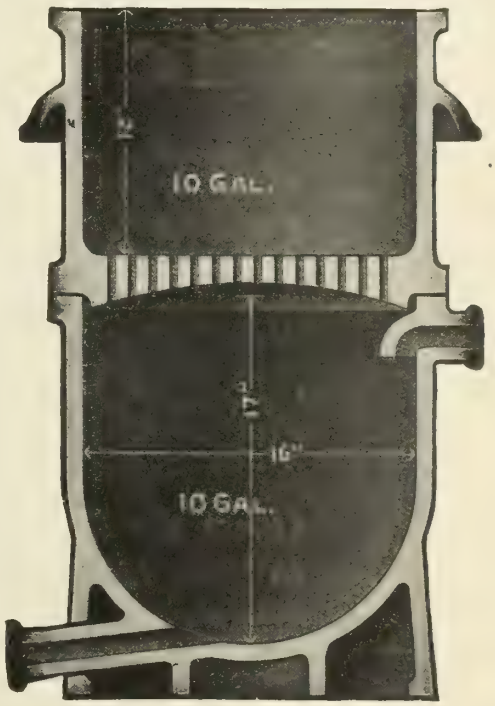

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Made in most any capacity up to 100 gallons. Furnished with faucet and cover if desired.

Knight Acid - Proof Chemical Stoneware does not depend on glaze, enamel or veneer

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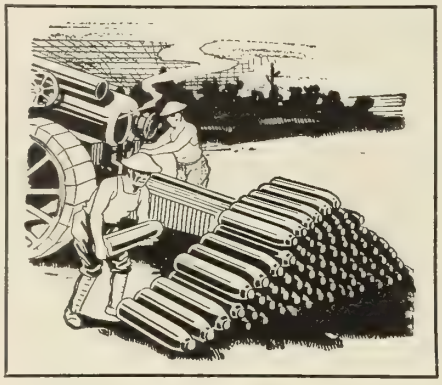

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IRON & LUMBER CO.
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NEWS FROM THE INSTRUMENT SHOP

(Being the fourth and last of a series of advertisements by Eimer & Amend, setting forth their chief attainments during the war.)

The uncommon achievements of our instrument shop during the past few years readily fall into three groups:

FIRSTLY, the experimental work on various apparatus for use of the American and Allied Military Forces.

SECONDLY, the rebuilding and refinishing of imported apparatus—some pieces could not be replaced on account of the lack of essential parts, while other pieces possessed sufficient salvage value to warrant reclamation.

THIRDLY, the building of complete instruments and apparatus to replace those of foreign manufacture. This third class, as well as the second, was carried to the point only where it would not conflict with the more important business of helping to win the war.

WORK ordered by the Government and done directly for it was perhaps the most interesting. Our files for 1917 and 1918 contain countless orders from the Gas Defense, Gas Offense, the Army Medical Schools, the Aviation Fields, the Medical Supply Depots, etc., for apparatus and devices of many special kinds "as per instructions to the Machine Shop." This labor was not limited to experimental work, but quantity production was also effected, as evidenced by the fact that thousands of gas detectors used by the American Army on the fields of France bore our trademark.

THE Sugar industry was greatly inconvenienced by the inability to procure French or German polariscopes. When the consequences had assumed a serious aspect, we undertook to remodel a Schmidt & Haensch instrument, including repolishing, cementing and repairing of the prisms. The results were so highly pleasing to our customer that we secured a continuous flow of orders of this kind from all over the sugar-producing sections of the United States, Cuba and Porto Rico. To the best of our knowledge, all the polariscope observation tubes produced in the world during the past two years (except those, if any, turned out by our enemies) were made by us.

AMONG precision instruments of similar class which we have taken the time to dismantle and remodel, let us mention Wanner pyrometers and Zeiss microscopes, including their objectives.

WE have manufactured **completely** Beckmann boiling point and freezing point apparatus; Duboscq colorimeters, quite like the original French, and, we think, better; Juerst ebullioscopes, to replace the Salleron; and also a number of other intricate physical apparatus.

IN addition to these, we have maintained and increased our normal output of such well known specialties as the three types of Young's specific gravity instruments (two styles embodying displacement plummets of incomparable accuracy) excelling in sensibility the highest class of analytical balance; Kimley electro-analysis apparatus; Gramercy stirrers, and many others.

THE capabilities and the facilities that raised this shop and its work above others of its kind are now available for the solution of problems like in nature to those indicated by the foregoing resume.

EIMER AND AMEND

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Plant of Canadian Industrial Alcohol Company, Limited, Corbyville, Ont.

With a capacity of 450,000 (proof) gallons per month we are the largest producers of Alcohol in Canada.

Manufacturers of vinegar, perfumes, essences, pharmaceutical preparations, etc., are invited to write us for prices of Alcohol suitable for their particular line of business.

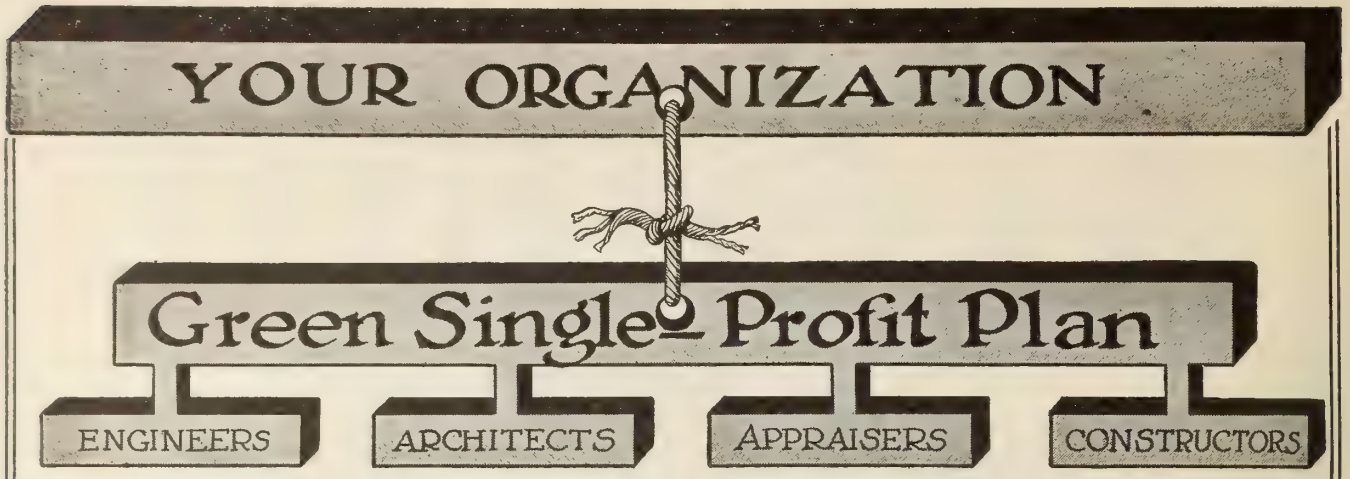
We make a special feature of contracting for the requirements of manufacturers for the year or season, thus providing not only a uniform cost but also a steady supply as needed.

Those who are using Duty Paid Alcohol in their manufacturing processes would do well to consult us with a view to using it "In Bond," thus avoiding the use of two-year-old Alcohol. Under the rules and regulations of the Department of Inland Revenue, newly made Alcohol may be used "In Bond." This Alcohol is much cheaper than two-year-old.

METHYLATED SPIRITS or Denatured Alcohol is sold only by the Department of Inland Revenue, Ottawa, Ont., but any other kind of Alcohol may be secured from us.

Canadian Industrial Alcohol Co., Limited

MONTREAL, QUE.



Tie this to your organization when you wish to build or expand

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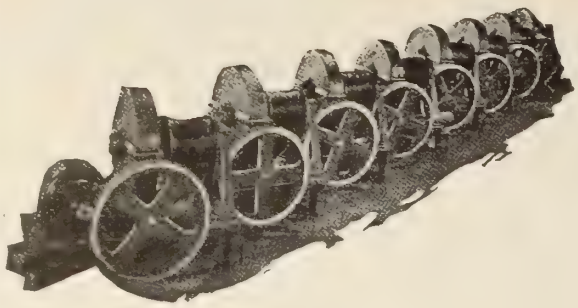

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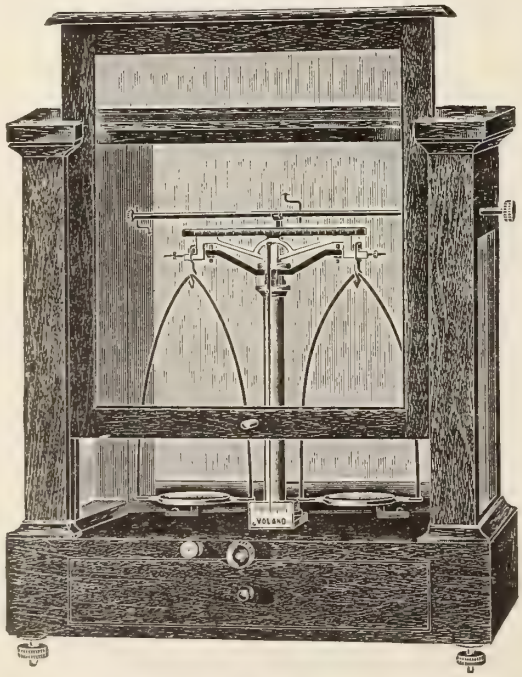

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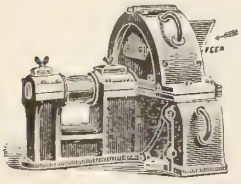

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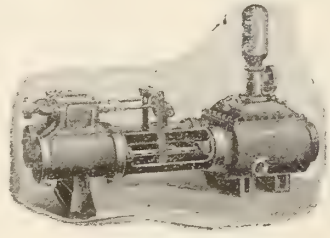

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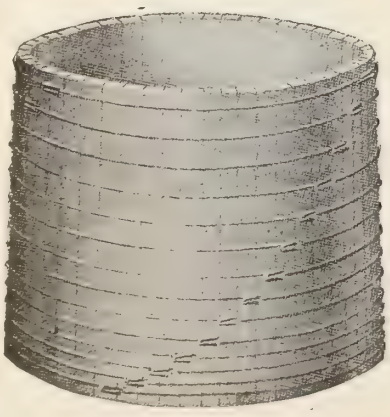

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THE UNIVERSITIES AND THE DOMINION GOVERNMENT RESEARCH COUNCIL.

IT would appear that certain differences of opinion exist regarding the functions of our Universities and their relationship to various possible sources of financial support.

The Honorary Advisory Research Council takes the stand strongly that it is impossible for the Dominion Government to finance industrial research directly through Universities and this opinion is based in part, at least, on the belief that such a move would not be in the best interests of the Universities themselves. In general, the attitude of Dominion Government officials is that the Universities should be better supported and pure science developed in post-graduate schools, directed by professors who were well paid and given time for such work. The money, however, must come from other sources than the Dominion Treasury.

Each University thinks for itself and, therefore, we have eighteen different points of view. Some of these institutions have had but little growth and are very much stunted, more especially along the lines of science, either academic or otherwise. In spite of this, they contain possibilities for development which should not be overlooked in any policy. Much of the confusion existing at the moment is due to an effort on the part of the Government to stand clear of any alliances which may prove troublesome and at the same time place in some Universities certain men who will really be working under Government control. If the Government cannot support industrial research in Universities it hopes to be able to lure along the younger graduates into channels of pure science. The first fruits of this policy do not seem to be arousing much enthusiasm.

There are already so many proposals that a coal tar tree will soon be necessary when following them. The Universities all agree that a Bureau of Standards would be a good institute to establish in Ottawa, but beyond this lie troubled waters. The Universities feel in some instances that they are quite fitted for

more support and greater opportunities in matters connected with specific research problems. They feel more keenly the necessity for bridging the gap between the academic man and the industrial plant and have had some real experience in such co-operation. It cannot be taken for granted that men who have spent years in academic work or research work in lines of pure science, out of contact with industrial affairs, are able to step out and work wonders in a short time in our industries. We need no gap in our system and the business of the hour is to create a smooth path for the flow of knowledge in all directions from the fountain heads of pure scientific research. The practical move to make would seem to be the bringing of University work, or some section of it, into closer touch with real timely industrial problems. The Government desires the result, but not the method. Why may we not have unity of action and push all lines of useful effort?

Those officials who hope to guide the construction of a Research Institute or a Bureau of Standards at Ottawa should remember that their chief asset will be the good-will of other Government departments, Universities, industries and a host of individuals. Virtue exists only in the results obtained and our industries may thus be won over slowly to the idea that Ottawa can assist them in any real sense. They are more familiar with University men and the local connections are stronger. Universities can act as individuals, make specific arrangements, and in a sense may be partial to certain companies. They can produce results for them by means not open under the general plans of a Government Bureau of Industrial Research.

Some criticism might be rightfully aimed at the organization appointed to act as an Advisory Research Council. No matter how unanimous their opinions may be, it is no token that wisdom follows their movements. We have exalted position and academic standing and have neglected to add a few grains of common salt. While the statement may seem foolish, yet it is probable that any equal number of industrial chemists or engineers with a few years' experience would go at the business in hand with an equally keen appreciation of the problems.

Academic men of high standing have a tendency to talk about the lack of initiative and research qualifications of recent graduates. Now, this is a line of nonsense that should be stopped. There is little to be gained by discounting the material available. No amount of training at any University would quicken the mind or produce leadership in some men who, when placed on a trail are able to follow it with fair success, and who sometimes produce surprising practical results. Our leaders of industry have evidently thrown this bluff at the heads of our academic weakling leaders and they have stood by and said "Yes." These graduates are all we have and on the average they will produce results in our factories and research laboratories just as well as many of their professors ever would. The trouble lies to a greater extent with the industrial machine. From foremen to managers, University graduates have to fight against conditions which are most disheartening. If a man has degrees, he discards them around the plant. What we need are men leading our Research Institute who are not afraid to go out and tell manufacturers they do not know their own business, instead of agreeing so politely with them when they whine that science graduates lack "initiative." They will never get much initiative by staying near some of the men who have made a profession of university teaching and academic research.

We have faith in the gradual setting of all these forces now so hotly striving to maintain their will and to direct really great movements along certain paths. We need all grades of research workers and we need both quality and quantity. They will be absorbed as produced, but we must get on with the business, remembering the aim and not delaying to disagree too much about methods.

SCIENCE ON THE FLOOR OF THE HOUSE.

THE houses we refer to are situated in every Province and at Ottawa. They are called parliaments and are presumably constituted to represent and guide the growth of our country as well as establish and maintain law and order.

Their membership consists of a few active men and a very large number of stationary objects. The chief qualification for a political career is the desire expressed by the individual. A man is placed on a platform and pushed along towards the House. When he arrives, he remains on the average in a state of coma until the next zero hour is due.

It is all a very complicated machine which no sane citizen would abolish if he could, and yet the whole structure cannot help but bring a laugh at times. Parliaments are hopelessly cumbersome and at best can give individuals but nominal representation. Further than this, our governments do not give whole classes any power of expression. Scientists to-day in English-speaking governing bodies are treated in the same way that mediaeval French governments treated poets, artists, and men of letters. They are still patronized.

Power is but seldom vested in men who are really scientifically trained in a practical way. Other professions monopolize everything greatly to their own

detriment and the slowing-up of trade and commercial development. We have had very recent examples of this. After admitting that everything depended on industrial research and that there was no other way of stopping the appalling wastage in our national resources through ignorance, avarice, and lack of science, the Dominion Government appointed a group of scientific men to act in an "advisory" capacity. A sop was prepared and thrown into the hands of one of our leading Canadian academic research workers. The results, no matter how wonderful they may appear, are but indications of what might have been done if the problem had been faced squarely and a real development policy adopted. Instead of creating a position of servility the Dominion Government should have created a Ministry of Science with a Minister who brought new blood, the like of which has never yet entered the Canadian House of Commons. This country needs a Ministry of Science to-day as much as it needed a Ministry of War one year ago. This "Advisory" business is weak—there is no punch to it. Real strides could be made if equality of power was granted to someone properly trained to understand and accelerate the growth of those ideas upon which we are now spending the few hundred thousand dollars that are likely to be voted. The people of Canada have so far failed to elect a single representative properly equipped to hold such a position in the Dominion Cabinet. The result is that we are floundering along when we should be speeding.

Now, such radical conceptions as the creation of a Ministry of Science to direct and control the expenditure of public funds along lines of scientific development may be beyond the desire of the Dominion Government, and it is but little wonder when those individuals who might start such a movement are measured up by their capacity to understand and carry on such a momentous task. We would suggest that a beginning be made in smaller units, namely, the provinces. All the larger provinces should immediately undertake to appoint some one in their Cabinets who, in the first instance, was capable of organizing a Department of Science. It would be the business of this Department to stimulate and assist other branches of Government; it would undertake to guide the growth of industries along scientific modern principles. It would spend money, of course, and large sums at that, but it would be the best investment ever made by any province. We must utilize our knowledge and get the new started as well as remodel the old.

Now, it is evident that industries now having local settings desire local short-distance attention. It does not meet the situation to spend a paltry $600,000 in Ottawa. In the first place, it sounds so foolish in the ears of industrial men that they simply forget the whole plan at once and there the matter ends. A Bureau of Standards has a value, but when it gets mixed up with guilds and students the vision fades. Our industries are generous to their sales departments and our Government has not the nerve to even ask them to pay their way in developing real advances in production. The organized industries are simply taking the Government at its word and until real action is developed and a worthy development policy outlined they are not even likely to start. Men capable of organizing our industries for research purposes have so far not been in evidence at Ottawa.

The situation is one which demands provincial attention. The needs are so great that each province might well do as much as is now proposed for the whole Dominion. Lawyers, doctors, farmers, or wealthy industrialists need some assistance in solving the problems of this country. The power to actually direct expenditures must be placed in the hands of men, capable of judging for themselves the real value of such an outlay, and who are in a position of prominence in the public eye.

We would consider it a mighty step in advance if the three middle provinces of Canada struck out at once and made a conscious effort to embody within their political organization one man, at least, in each province upon whose shoulders might rest the burden of directing and developing our national research efforts upon truly scientific lines.

These men must be men of parts, trained in science by wide travel and research, both academic and industrial. They must have the qualities and force of business men who can organize, get action, and do things. Above all, they must have faith in themselves and the possibilities of things yet visionary to the average. They would be scientific poets and yet keenly practical with it all. If men such as these could be persuaded to enter the broader field of work a policy might be developed which would really bring to pass these things we love and dream about for our native land. Men could be found well qualified for these larger fields and in order that a constructive policy may be outlined we would suggest real living men who would rank high in those qualifications so essential in organizing business men in matters connected with industrial scientific research. If the Ontario Government could be persuaded to come out and make a place in the Ontario Cabinet for such a man as James Watson Bain, now in Washington with the War Trade Mission, and the Provincial Governments of Manitoba and Saskatchewan were represented right in the Government by such men as W. G. Chase, of Winnipeg, and R. D. MacLaurin, of Saskatoon, there would be a beginning

made of an organization with power and with the qualification for successfully developing our industries to their full capacity. We mention these men specifically not because they alone could lead, but because they are outsanding types of what is needed.

The provinces should not look to the Dominion unduly long for something which they are not likely to receive and which would be as well done by themselves.

The time may be long or short before any really able, scientific man may be elected to a place of power among the people of this country, but it is in the interest of wealth and poverty alike, as well as every industry in the country, that the time be hastened. Science must remain enslaved in all democracies where it exists in an "advisory" capacity, as far as its relationship to national action is concerned.

SOLVING TARIFF TROUBLES.

THERE is a debt to be paid and each class in Canadian labor is putting forth every possible effort to shift the burden. Modern industrial warfare is much better organized than ever before; therefore, the former methods of argument and action cease in a large measure to have much charm. The printed statement is questioned on every hand and has lost most of its former weight in the mouths of so-called leaders of political thought and action.

We are facing problems in the fields of geology and science as well as in the realms of labor and tariff, and some few are beginning to recognize them as such. The fundamental cause of the present situation is due in the main to the peculiar differences in resources which follow naturally after you have drawn a line across the middle of North America and postulated that the interests of all people living north of that line shall be treated as if they were in common. The line has been drawn and the people are here and nothing remains but to make the best of a situation which nature, to a certain extent, never intended should exist.

The Canadian manufacturer will never conquer the central plains of Western Canada until he has established a group of industries in those provinces similar to those now flourishing in other parts of the Dominion. Western interests will think in terms of agriculture and vote that way until they begin to see that the kind of agriculture they now indulge in may bring them to an early financial grave.

The present single-mindedness of these three Western Provinces is probably at its height and it should be the business of Canadian manufacturers and Western leaders to see in what ways nature has provided for complete cycles of industries in these Provinces which now appear to desire specific legislation along certain lines which in a few years may easily react against their best interests.

If the future of Western Canada depended only on the production of wheat, year after year forever, and this was assured, then there might be no common ground upon which all Canadians might stand in matters of tariff. However, this is far from being the story of the future. Within this generation a change is due in the situation. Agriculture will flourish permanently in Western Canada, even as it does in every Province, but the situation will become gradually more complex. There are natural resources in minerals, oils, clays, forests, fuels and water powers in every Western Province which in a short time will tend to completely change the point of view of those whose capital is now so closely connected with the single idea of exporting wheat. We need men in these provinces who can not only grasp the possibilities of agriculture, but who have the larger vision of what the complete development of these natural resources signifies, and that not in the far-distant future. Agriculture itself must be modified into a complex system involving manufacturing processes right on the ground.

The present tension in the House of Commons at Ottawa and the desperate effort being made to throttle an immediate clash of interests could be smoothed in a measure if the Government would undertake a broad development policy in the West and if Canadian manufacturers would consciously set out to demonstrate to Western Canada some of the things that must eventually come to pass in any event by the growth of various industries in connection with the natural resources of these Provinces. Every portion of the Dominion can develop manufacturing and farming interests at one and the same time and in this way only can we solve our problems and overcome in a measure both distances and primary types of development.

There are young men working as clerks in departmental stores in Canada who have been through the army and who are graduates in honor science courses from leading Universities. If the Government and the Research Council could even compete in salaries with such organizations, would not more men be available to work on the urgent problems we hear about? This is a practical world and above all, a man must eat to live. "Researchers" will remain in Canada or come here for one reason only and manufacturers and Governments must first realize this. Where the money is there will the modern brains be also. If this is true in any sense it should be true for research laboratories.

MINERAL PRODUCTION IN ONTARIO, 1918.

IN value, the minerals produced in Ontario during 1918 greatly exceeded the figuers for 1917. The percentage for this province is now close to one-half the total output of the Dominion. It would not be surprising if in 1919 Ontario produced over 50% of the mineral wealth of Canada for the year. This is likely from the stimulus that is being given the production of gold, silver and nickel and the probable falling off of production elsewhere. Metallic minerals increased from $56,000,000 to $66,000,000 while the non-metallic output went from $72,000,000 to $80,000,000. Increased prices, of course, account for the increased showing to a certain extent. In some cases there was a falling off in production for various causes. Natural gas, which is considered as a non-metallic mineral, dropped about one-third in quantity used, as a result of government action, reserving the supply for domestic uses chiefly.

When distant natural resources are being highly praised as worthy of the interest of investors, it is a question whether those well-meaning individuals have ever realized the possibilities which exist in the centre and at the very doors of North America's greatest manufacturing areas. A rough classification of these mineral resources would show forty-one items. How many Canadians living in Ontario could name thirty of them?

There are districts in Ontario which, because of circumstances at the time and a certain lack of knowledge regarding methods of development, have been overlooked. We have passed on to more immediate wealth but indications point to a return of activities in districts which years ago were turned down as not likely to produce at a profit. Our ideas have changed and we are beginning to see possibilities in industries that were not previously recognized. In the Lake Superior district there are iron ores and gold deposits awaiting proper development. In older Ontario and in the region north of Kingston we have sources of wealth in marble, fluorspar, graphite, molybdenum, talc and lead. By proper organization in production and the combining of one resource with another, capital cannot lose in working up some of those materials.

The growth of Ontario refineries is exceedingly important. Public attention and the search for possible tax carriers is forcing the nickel industry into the minds of governing bodies. The results are gradually showing and Ontario and Canada are likely to actually realize on this resource more and more in the future. During the year 1,643,040 tons of nickel ore was raised and of this amount some 1,104,673 tons came from the Creighton mine. In all, 87,184 tons of Bessemer matte were produced, containing 45,886 tons of nickel and 23,483 tons of copper. This was the biggest output ever made. The International Nickel Company at Port Colborne commenced operations in July and treated 3,334 tons of nickel-copper matte. In silver refining, the three plants situated at Deloro, Thorold, and Welland, treated 8,354 tons of concentrates. Although lacking in iron, steel production amounted to over $28,000,000 during the year. In ferro-alloys the electric furnaces were busy, indeed. Ferrosilicon to the extent of 36,226 tons was produced chiefly by Electro-metals, Limited, at Welland. At Orillia and Belleville, 19,410 pounds of ferro-molybdenite, valued at $59,153, were produced.

The mining report for the year is most encouraging and prospects for the future are very bright, indeed. Ontario, of course, is not the only mineral producer in Canada, and every province has special fields of great importance from the national viewpoint. The greatest need is more capital and a broad development policy. Both these necessities are on the way, and with the settlement of affairs in Europe mineral production will be off with the gun in Canada and per unit of population this country looks like a world leader all the way.

THE CHEMISTS' ORGANIZATION COMMITTEE.

WE feel that the chemists of Canada should declare a holiday and rejoice that out of the various forces which have "co-mixed and co-mingled" to bring them to the point where they now stand, something has been born which may solidify their national respect and stimulate their individualism and independence for the betterment of their whole profession in this country.

The Magna Charta of chemical independence is presented in this issue in the form of a report from the Chemists' Organization Committee and should be studied carefully by every chemist and chemical engineer. The committee appointed last May at the first convention of Canadian chemists has, under great difficulties, prepared a full report. It is simply their desire to lay it on the table for discussion in order that every one may be prepared in his own mind for definite action when called upon.

Now, it is very likely that differences of opinion will arise, but it must be understood that what has been presented here is a basis only upon which to build. The structure may be reformed, rebuilt, or in part discarded. It contains the framework of a valuable movement and is deserving of all the helpful criticism that may be forthcoming.

This Journal invites the chemists of Canada to use its columns in expressing thoughtful criticisms and opinions or in working up enthusiasm for this movement. Very little can be obtained without effort and some personal sacrifice. As a main line of guidance it might be suggested that what other older profes-

sions have done, chemists can do, and if you do not get in the fight for your own profession, you are deserving of everything that may tend to submerge your influence and rightful measure of recognition. If you have faith in yourself as a chemist and your profession, as an industrial factor of great weight, do not hesitate to come out in some positive way in connection with the biggest movement that ever came before Canadian chemists.

In May, at Montreal, the second convention will be held and definite action taken. It is a duty to consider these proposals from the broadest viewpoint possible and to bring the whole matter to the attention of everyone who should be interested in the movement. If you do not agree with the proposals in every way, you are at liberty to draft your own amendments, knowing that they will be given every consideration by a representative body of chemists at the Montreal Convention.

DOCTORS DIFFER AND INDUSTRIES DIE.

THE Doctors are those gigantic minds now fussing about industrial research at Ottawa and our Universities,

There are rumblings of great discontent with their manner of speech and work. Now they are all good men, but there is a danger that in their greatness they may get so far beyond the industrial mob they are leading that communications may be entirely cut off. Their greatness, like certain suns in the heavens, is well recognized, but their heat is not felt. It is a penalty they pay for their specialized variety of mentality. It is a pity, but it is the way of the world. Our struggling industries need help, but leaders whose voices are more familiar and whose hands are perhaps rougher, should be more in evidence. They, possibly, and they alone could reap benefit from communication with those Field Marshals who are now trying to direct privates without any intervening officers. We need a corp of industrial guides in order that our scientific efforts be not lost in the rising fog. We seem to need everything at once and it is little wonder that issues become confused. Headquarters, for the moment, is delightfully muddled and there is evidence of firing from the rear. Politicians and manufacturers should make a larger effort to appreciate the situation in a national way.

BRITISH COLUMBIA IRON ORE EXPERIMENTS.

SOME years ago, magnetite ore from British Columbia was smelted at Irondale, Wash., to supply material for United States warships. The recent war development of British Columbia steel shipbuilding industry depended upon material shipped overland from eastern United States.

Following upon Dr. Alfred Stanfield's report, the legislature of British Columbia propose to supply up to 10,000 tons of magnetite ore for experimental purposes. The Tudhope Electric Metals, Limited, have asked for 5,000 tons. Their present equipment is a 1,500-kw. furnace with a daily capacity of 25 tons, using scrap iron. They propose to make the necessary changes to demonstrate the feasibility of using native magnetite ores on a competitive commercial basis. The Vancouver Magnetite Iron & Steel Smelting Co., Limited, whose plant is at Ronaldsay, on Howe Sound, 27 miles from Vancouver, have been producing pig iron by blast furnace from scrap, with a capacity of 25 tons per day also. They are prepared to install auxiliary fuel oil burners to obtain the 3,000° F. temperature necessary to flux the magnetite and limestone.

In Nova Scotia, the iron industry started in a little forge shop with a capital of $4,000 and ten employees. Now it is one of the most notable enterprises in North America. In British Columbia, cheap explosives, water transportation, hydro-electric power, coke, charcoal, limestone and magnesite are available in abundance. If the bog ores of the Coast Range are not in sufficient quantity or purity, haematite might be imported if necessary. Sweden has succeeded in treating native magnetite ores. Why should not Western Canada establish this most fundamental of all key chemical industries? With proper organization, scientific research and control, and a fair degree of protection and assistance, the proposed investigations increase our optimism that the thing can be done.

INTERNATIONAL MINING CONVENTION IN BRITISH COLUMBIA.

THE prospector, the mine, research and new industry—these suggest the chronological order of progress. Christopher Columbus, prospector, set up a discovery post and was rewarded by great contemporary injustice, which practice is not unknown even in the present age of enlightenment. Then, after a period, George Washington carried on development of the discovery, and became the "Father of his Country." British Columbia and the State of Washington, side by side, commemorate in name the achievements of the Genoese navigator and the Anglo-United States general.

Were Vancouver as favored by the Divas as is Toronto, a "Louis Benjamin" might well have instrumented messages of inspiration from Christopher and George to the International Mining Convention held March 17-19, by the B.C. Chamber of Mines at Vancouver. Possibly our Columbus-like treatment of locking up Musclow, the gold prospecting astrologer, put us out of tune with the 20th plane.

Otherwise, the convention was completely up to date. Prospectors, miners, researchers and industrialists rounded up from Dawson City to San Francisco, from Victoria to Spokane and fraternized over 2½ proof, more or less. The wonderfully complete display of ore samples, flotation, concentrating, and mining machinery, the practical papers and lively discussions, with the inspection of the great Britannia copper mine on Howe Sound, indicated a renewal of vigorous offensives by the allied Pacific forces all along Nature's Cordilleran line. The business men of British Columbia co-operated in making the conference an occasion for expansion of trade and industry, realizing that the development of mineral resources brings wealth, influence and independence. The discussions of men of knowledge and experience from all parts of the continent were followed with extreme interest. Capital and labor are more than ever, ready to pay homage and a pittance for the ideas of the man of science.

PUBLIC POLICY AND THE CHEMICAL INDUSTRIES.

THE chemical industries of Canada and the United States no less than those of Great Britain and France were born out of the stress of the Great War. Without the successful reconstruction of these industries in the allied countries, the war would have been lost, for science and brains, more than muscle, determined the outcome. The rapid establishment of factories producing explosives, miscellaneous chemical works, as well as munition plants and metallurgical works with their necessary laboratories, stands as one of the great miracles of the war. To create these, the owners of industrial plants abandoned their ordinary peace operations and surrendered their rights for the national cause. Some of them found it profitable, while to others the change meant financial loss. To all it meant the breaking up of old connections and a disruption of business when the war ended. When the creation of the war chemical industries was determined by the Anglo-Saxon nations it was well understood that never again would these nations be placed at the mercy of their enemies in the production of those chemicals that were recognized as key industries.

From these cardinal facts it becomes essential to Canada, the United States and Great Britain that what was demanded as vital to winning the war is now also vital, if the chemical industries are to be safeguarded during the era following the war. Otherwise, our last state will be worse than the first.

The preservation and sound development of the chemical and metallurgical industries becomes, therefore, not a question of tariff, but a question of national safety. A number of these established for war purposes at a cost of millions of dollars, now find themselves faced with a serious problem. As they were established by Government action and Government command, so they ought to be secured by Government intervention during the period of reconstruction. This is required by common justice as well as the plain logic of the case. In Great Britain, France and the United States the situation has been taken in hand by the control and regulation of imports affecting these industries. In Canada there has been a laxness in this control, and a situation has developed which demands a wise foresight if industries established at heavy cost are to be safeguarded during the transition period. Some facts on this situation will be given in another issue.

Lloyd George is quoted as follows when addressing some of the leading industrial men in England in connection with recent labor troubles: "The daring of Britain won the war; let there now be daring in industry."

Great men in their eloquence strike to the heart of things and we humbly suggest that this motto be placed before the desks of those who hope to guide the work of construction and development in Canada: "Let there now be daring in Industry."

CORRESPONDENCE

AN APPEAL FOR THE ORGANIZATION OF CANADIAN CHEMISTS.

The Editor
Canadian Chemical Journal:

I should like, if you will permit me, to appeal through your journal to the chemists of the Dominion on behalf of the Chemists Organization Committee, appointed by the Convention of Chemists, held in Ottawa a year ago.

The members of this Committee (except myself) have held many meetings and have gone to a great deal of trouble in drafting an outline for the constitution of a proposed Institute of Chemistry of Canada.

The Convention seemed to be almost unanimously in favor of the formation of some such organization, so that it is hardly necessary at this time to enlarge on the advantages to be gained by the foundation of an association of professional chemists. Moreover, the chief objects are set forth in brief in the proposed draft constitution, published in this issue of the Canadian Chemical Journal.

I venture to urge the chemists of the Dominion to peruse this draft carefully and to respond to the request of the Committee to give an expression of opinion on any or all of the matters dealt with therein. The Committee has given much time and thought to this very important problem, and it might greatly expedite the business of the forthcoming Convention if the members of the Committee were given the opportunity of considering any such opinions or suggestions, and of incorporating them in their final report to be presented at the Convention.

I sincerely hope that some such scheme as that proposed

will be carried into effect at no distant date. Unless the chemists of the Dominion are brought together in this way, it seems unlikely that the profession will ever attain to that degree of importance and influence which it undoubtedly deserves. I am, sir,

Yours truly,

MATTHEW A. PARKER.

Winnipeg, March 13, 1919.

A LETTER FROM AUSTRALIA.

EDITOR CANADIAN CHEMICAL JOURNAL:

As a native of Toronto, my interest in anything emanating from that beautiful city is always lively, and the visit I paid to it recently was full of surprises. It was with chagrin on entering the city by rail that I found the same old dingy railway station and approaches, grown more dingy still than they were in the year 1877, when I left for Australia. I have been informed that wonderful changes are in contemplation, and I have seen the structure that is to be the new railway station. Of the beauty of the new residential area of the city, I have abundant praise, and I may say I saw nothing to compare with it in any of the American cities. The old University building in which I passed my examination in chemistry, many years ago, still stands a monument of beautiful architecture. Some of the old members of the Pharmaceutical College may still remember Dr. May, who held classes in Chemistry the year I passed.

My life in Australia has been spent in the manufacture of perfumery and toilet soaps, and, incidentally, in the laboratory, experimenting with various Australian products, with a view to discovering new perfumery material. While I have had many failures, I have had some successes that more than counterbalance them. For instance, I have produced commercially, ionone from the essential oil of citriodora backhousia, an Australian natural product. Not that there is any great credit due me for so doing, but that I was the first to produce this wonderful violet perfume from that source. The idea suggested itself to me from the fact that the essential oil of citriodora backhousia contains a large percentage of citral. After eliminating this product, the transformation of it to ionone, was simply a matter of carrying out the direction of known literature on the subject. It is true that even past graduates at universities have made many unsuccessful attempts to follow my lead, and I still remain the only producer of ionone in Australia. If there is any secret in the process, my experience tells me that it resides in the necessity for close adherence to the conditions of temperature, and vacuum pressure. A fraction that distills at 135° C. at 11 mm. will not distill pure at any other temperature at the same pressure.

I have found that Rhodinol can be eliminated from the oil eucalyptus macarthuri; but here, again, the operation is difficult. Geranyl acetate is the chief constituent of this oil; I extracted it by fractional distillation at 128° C. and 16 mm.; saponified the product to remove the acetic acid, and by the usual process reduced it to rhodinol.

Eucalyptus maculata I found to contain a large percentage of citronellal; after careful re-distillation, I extracted the aldehyde with a hot saturated solution of $NaHSO_3$. As the process is described in current literature, I need not recapitulate. I then reduced the Aldehyde $C_{10}H_{18}O$ to the alcohol, citronellol $C_{10}H_{20}O$ with acetic acid and sodium amalgam. These two items, rhodinol and citronellol, are the chief constituents of otto of rose, and the third item, phenylethyl alcohol, made by the reduction of phenylacetaldehyde, make up my sum total of artificial otto of rose. The proportions were dictated by the sense of smell and taste, and the article produced is more or less satisfactory artificial otto of rose, suitable for perfumery, toilet soap, and confectionery.

JOHN K. BLOGG.

Normanby Road,

South Melbourne, Australia.

[The author of the above letter is well known to a number of the older pharmaceutical chemists and members of this profession in Canada. Besides his activities in the manufacture of perfumery, Mr. Blogg has become equally well known as an artist. His wood carvings, in particular, have commanded much attention.—EDITOR.]

WORK UNDERTAKEN BY ADVISORY RESEARCH COUNCIL.

The Advisory Council for Scientific and Industrial Research has taken steps to co-operate with the new Guild for Research formed by the Maritime Provinces Fish Canning Association, and it has made a grant of $2,000 to the Committee on Assisted Researches for investigating one of the fish-preserving problems to be taken up by the Canners' Guild. The Guild has made a first appropriation of $5,000 for research work.

The Research Council is arranging to publish, in co-operation with the Bureau of Mines at Ottawa, a bulletin on Canadian building stones, giving information as to their wearing and weathering qualities, economic values, source of supply, etc.

An important step taken by the Research Council in the direction of the application of science to industry has been the appointment of a committee to devise ways and means of aiding scientific journals in Canada and of securing the publication and circulation of scientific papers. The committee is composed of Dr. R. F. Ruttan, McGill University; Dr. A. S. McKenzie, Dalhousie University, Halifax, and Dr. A. B. Macallum, Administrative Chairman of the Research Council.

BAUXITE IN BRITISH GUIANA.

Bauxite was discovered in 1897 and deposits investigated in 1910. In 1913, the Northern Aluminum Company, of America, leased certain areas. During the war period, the British Government stipulated that any company working the deposits must be under British control. A company was formed, and British Guiana bauxite is now on the market, and can be loaded on boats drawing 16 feet at 60 miles above Georgetown on the Demerara River. It is estimated that the Guianas contain more extensive deposits of this aluminum mineral than any other countries, and local electrical developments are likely, as waterfalls are available. Canada has a rather special interest in this as a producer of aluminum and a possible absorber of the Government of this colony.

SUGAR BEET INDUSTRY GROWS.

During the year 1918, fifty million pounds of sugar were made in Canada in the three factories of the Dominion Sugar Company at Kitchener, Chatham, and Wallaceburg, Ontario. This fifty million pounds were made chiefly from 200,000 tons of sugar beets grow mainly in Kent, Essex, Lambton and Waterloo Counties. The sugar beets proved a very profitable crop to the farmers who grew them, the average return for such a crop being $100 per acre.

The Application of a Chemical Laboratory to a Departmental Store.

By G. W. Scott

Chemists have found their way into practically all our industrial organizations. These men are busily engaged in tetsing raw materials and finished products. They see that each batch of finished material is an exact reproduction of the previous one, or that the raw materials entering into these finished products are in such proportion as will give the best results. In order to sell goods they must be first purchased. Therefore, the time has come when the chemist should be recognized as a valuable factor in the organization of a departmental store.

The good will of any business means footsteps coming to its doors. This good will may be impaired in several ways, some of which are: misrepresentation in advertising goods, inadvertent statements by clerks to customers, inefficient clerks and assistants, and buying by guess work on the part of the buyer of the house.

A firm in order to become great must attain to high ideals; it must treat its customers with courtesy and respect, and be in a position to offer the best possible value for the money expended. The chemical laboratory is a great asset to a departmental store, in so much as it assists the management to overcome obstacles and helps them attain their ideal.

To-day is a day of Research. The Governments of countries are spending large sums of money on chemical research, to improve general merchandise, to improve working conditions, to utilize waste materials and to meet foreign competition in goods. A departmental store may be likened to a government of a country in the sense that, if it is going to protect customers' interests and improve the merchandise it sells, it must have a chemical laboratory.

Starting with the clerks of the house, the chemical laboratory produces more keenly, intelligent help, with a greater interest in the merchandise handled. The clerks are taken through the laboratory in small parties, the class of merchandise handled by them is tested before their eyes, the whys and wherefores of each process are explained to them, with the result that they go away educated to take a keener interest in the business. A clerk may know a Leicester wool from a Botany wool, a serge from a gabardine, but if he sees a thread from the actual piece of material taken and tested out under the microscope, so that he can see the difference between the markings of a cotton thread and a linen thread, then he appreciates in no small measure the work of the laboratory.

With an interested staff of workers, the business of the firm goes on without much trouble, thus inadvertent statements are guarded against.

It is a pleasure for the customer when asking a question about an article for sale to have the clerk give an answer without hesitatancy. A customer may ask: "is this article nickel or tin-plated?" It is far better for the customer to hear the clerk say definitely, "it is nickel-plated," than to hear him say—"well—it is supposed to be nickel," or "we bought it for nickel-plated." The clerk knows that the article is nickel-plated, as it was tested in the laboratory.

The four years of war have affected the markets of the world to such an extent that manufacturers fall down on their deliveries, stating that they cannot obtain raw materials to finish their contracts; they then offer substitutes. The chemical laboratory comes to the assistance of the department and tells them whether or not the value is in the substitution.

A very famous potter of England broke an expensive jardiniere, a product of his own kilns, because of a slight flow which was not apparent to the eye. A customer might have purchased it and would have been satisfied, nevertheless the potter felt guilty and broke it. The laboratory protects the buyer from the manufacturer, who will not try to misrepresent his goods or push an inferior article if he desires future business.

The buyer of to-day must know his goods. In a great many cases he buys on sample. The laboratory reports on the sample. The buyer places an order. When the first delivery is made, a sample is tested to ascertain whether or not the delivery comes up to the sample. If it does, all well and good, if not the shipment is rejected.

The improvement of merchandise, the better quality of articles, the best value for the dollar, are best pointed by individual cases. Nothing can be so degrading to a firm as to be called to account for some trivial offence unknown to it, as, for example: the governments of countries have laws pertaining to foodstuffs. Do the foodstuffs sold in the store meet these requirements? Here, again, the laboratory steps in and says yes or no.

The market is flooded with patent medicines, the majority of which are neither harmful or beneficial. Should some of these contain poisons, it is the duty of the laboratory to see that the label reads "Poison." Also many of them make rash claims, having absolutely no foundation in the strength of their ingredients. The laboratory keeps posted on the market price of raw materials that enter into foodstuffs and drugs, in order to give an opinion as to the value of the finished product. Is it not a great asset to handle only honest merchandise and no fakes? When customers enter the door they know that the articles they buy are as represented both by the clerk and by the label, if there is one; that the groceries are all up to their standard; that the pepper does not contain ground up shells, and so on.

Will the dyes of to-day wash, are they fast to light and perspiration- Can a dress be cleaned should a customer spill something on it when she is at a social function? All these points can be determined in the laboratory, thus insuring proper merchandise and a satisfied customer.

Where a department wishes the manufacturer to make merchandise according to their formula, the laboratory sees that it is done. and that the manufacturer does not substitute other ingredients, thus cheapening and making an inferior article.

The laboratory educates the clerks, the advertising department, and the manufacturers who sell to the firm. It thus produces better merchandise, better service, and offers the best values obtainable. It is a direct protection to the customers and the good-will of the business. This is the application of the chemical laboratory to the departmental store.

Toronto, Ont.

First Report of the Chemists' Organization Committee.

A Preliminary Statement Issued by this Committee, Giving Results af Their Work and Presenting Plans for the Canadian Chemists

ON May 22nd, 1918, at the Chemists' Convention, held in Ottawa, the following resolution was passed: "Resolved, that whereas this meeting is of the opinion that it is desirable to form an Association of Chemists, the Chairman do and is hereby authorized to appoint a Committee to report in the matter to a future meeting." Carried. As a result of this resolution, the "Chemists Organization Committee" came into being. The following are the members of the Committee:—

Members of Committee.

Chairman: Professor M. A. Parker, University of Manitoba, Winnipeg.

Secretary-Treasurer: Harold J. Roast, F.C.S., 393 Guy Street, Montreal, P.Q.

Executive: E. G. R. Ardagh, B.A.Sc., University of Toronto, Toronto; Dr. J. S. Bates, Forest Products Laboratories of Canada, Montreal; Dr. George Baril, M.D., Laval University, Montreal; Dr. Harold E. Bigelow, Mount Allison University, Sackville, N.B.; Dr. A. T. Charron, Provincial Laboratory, St. Hyacinthe, Que.; J. A. Macdonald Dawson, B.A., Dept. Trade and Commerce, Vancouver; Dr. L. F. Goodwin, F.I.C., Queen's University, Kingston, Ont.; I. Grageroff, Esq., Canadian Explosives Limited, Montreal; Dr. D. M. McIntosh, University of British Columbia, Vancouver; Dr. A. McGill, Chief Chemist, Dept. Trade and Commerce, Ottawa; J. Race, F.I.C., City Bacteriologist, Ottawa.

The Committee, after careful consideration, has concluded that the best way to carry out the instructions of the Dominion Convention is to publish a preliminary report embodying its conclusions, in order that the chemists of Canada may be seized of the situation.

Recommendations in Detail.

It is the opinion of the Committee that:—

1. The Organization of Canadian Chemists is best undertaken by an entirely new and separate organization rather than by endeavoring to carry out such organization under the auspices of any existing society.
2. The name, "The Institute of Chemistry of Canada," is the most suitable name for such an organization.
3. The nucleus of the proposed association be a body of Charter Members.
4. The membership consist of two classes, Fellows and Associates, the former having the right to use the letters F.I.C.C., and the latter having the right to use the letters A.I.C.C.
5. The following be the requirements for Fellows:—
   - A. One who shall be of the age of twenty-five or over, being a graduate of a recognized university having a four-year course in Chemistry or Science, and who can satisfy the Board that Cmemistry, Pure or Applied, has been his major subject.
   - B. One who shall be of the age of twenty-five or over, being a graduate of a recognized University, giving only a three-year course in Chemistry or Science, who can satisfy the Board that Chemistry, Pure, or Applied, has been his major subject, and who has taken another year's training in Chemistry at a University, or has had two years' experience in Chemistry in a laboratory approved by the Board or under the direction of a Fellow of the Association.
   - C. Such candidates as are of the age of twenty-five or over, but who cannot qualify under provisions A and B, must have been actively engaged in either Pure or Applied Chemistry for at least five years in a responsible position, and shall be required to pass an examination before a board of examiners appointed by the Council. The Candidates shall be examined on the theory and practice of Chemistry, with special reference to the branch of Chemistry in which they have been engaged. This examination may be waived at the discretion of the Council if the Candidate was engaged in Chemistry at the date of the incorporation of the association, and has had a position of professional responsibility for not less than ei years:

   The following be the requirements for Associates:—
   A person eligible for membership as a Fellow under provisions A, B or C, except that he (or she) is under twenty-five years of age, shall be eligible as an Associate.
   An Associate upon reaching the age of twenty-five may become a Fellow, providing he is recommended by five Fellows and has been engaged for at least two years in the practice of Chemistry, Pure or Applied.
   Each Candidate shall be examined by the Board, to satisfy the said Board that the Candidate has a good general education.
6. The officers of the organization be:—
   1. President.
   2. Three Vice-Presidents.
   3. Secretary-Treasurer.
   4. Executive Board, consisting of President, Vice-Presidents, Secretary-Treasurer and ten other members.
   5. Examining Board sonsisting of, say, fourteen members.
7. The entrance fee for Fellows be twenty dollars, in addition to an annual fee of ten dollars, and that the fees for Associates be one-half the above. All fees payable in advance.
8. The objects of the Association be:—
   "A" To raise the profession of Chemistry to its proper position amongst the other learned professions, so that it may attract a larger proportion of the best intellects and thereby secure a supply of trained chemists adequate to the growing industrial needs of the country.
   "B" To form an organization immediately available for consultation by the Government in times of national crisis.
   "C" To protect the public by gathering together a body of men who may be consulted with confidence.
   "D" To look after the professional well-being of the Chemist by:
   1. Having a registration bureau for Chemists.

2. Having social centres for Chemists and Chemists only.
3. Maintaining an employment bureau for Chemists.
4. Having centres for the interchange of Scientific experience by both papers and lectures.
5. Maintaining a clearing house of available Chemical knowledge, including a library and suitable register that would enable the central bureau to put one Chemist in touch with that other Chemist who might be able to assist him in his particular problems (leaving it to the parties interested to arrange details as to recompense or otherwise).

"E" To secure such Government recognition as may from time to time be deemed advisable.

"F" To maintain a professional association for professional men.

The Committee invites the expression of opinion upon any and or all of the foregoing points from those who are interested in the matter.

At the Convention held last May, subscriptions to defray the expenses incident to the work of the Chemists' Organization Committee were asked for, and an encouraging response was received.

The sum collected at that time, however, was only sufficient to cover part of the postage, printing and stationery. The Committee will be glad to receive further financial support from those interested in the movement. Subscriptions should be sent to the secretary-treasurer, Mr. Harold J. Roast, 393 Guy Street, Montreal.

A list of subscribers will be issued from time to time by the courtesy of the Canadian Chemical Journal.

The following subscriptions have been received to date:

List of Subscribers to Fund of Chemists' Organization to March 11th, 1919.

E. G. R. Ardagh, $5; J. W. Bain, $1; J. B. Bell, $5; A. Brown, $2; M. G. Boswell, $2; C. Berkley, $2; G. Baril, $5; H. E. Bigelow, $5; J. S. Bates, $5; A. T. Charron, $5; J. R. Donald, $2; H. S. Davis, $1; J. A. Dawson, $5; M. H. Ellis, $5; F. O. Farey. $1; I. Grageroff, $5; W. L. Goodwin, $5; L. F. Goodwin, $5; W. H. Hill, $5; A. Lehman, $2; F. M. Mooney, $5; A. McGill, $10; A. G. Macintyre, $1; D. M. McIntosh, $5; M. A. Parker, $10; H. J. Roast, $5; G. H. Tomlinson, $1; W. A. P. Schorman, $2; E. Stansfield, $1; L. E. Westman, $1; E. E. Wells, $2. Total, $116.

After duly considering all suggestions received in writing, the Committeeittee will draft a final report for submission to the Convention next May.

(Signed) M. A. PARKER,
Chairman.
HAROLD J. ROAST,
Secretary-Treasurer.

THE POTASH SITUATION.

Deposited here and there over a great layer of rock salt extending through north and middle Germany, lie the beds of potash and other salts which in recent years gave Germany a world-monopoly of the potash supply. The deposits at Stassfurt, extending over a hundred square miles, became famous, as they contain not only potassium chloride, carnallite, a double chloride of potassium and magnesium, and kainite, a compound of magnesium and potassium sulphate, but other valuable salts, the production of which fell into the control of the Potash Syndicate. The syndicate's operations were "bossed" by the government, which regulated the amount allowed for export and the prices at which it should be sold in foreign markets. In 1914, 531,300 tons were allowed to be exported while 635,000 metric tons were retained for German consumption.

In 1904, extensive deposits of potash salts were discovered in Alsace, which to-day are under French control. These deposits are reported to contain a billion and a half tons of raw material, equal to 300,000,000 tons of pure potash. This is in the form chiefly of muriate of potash, easier to purify than the salts at Stassfurt. Owing to the destruction of machinery by the Germans during the war, it will take a year or more to put the Alsace potash mines in proper working order, but when that is done the annual output will be 800,000 tons, which will be about ten times the production that was permitted to the Alsatian mines by the Germans before the war. In other words, the world will get from Alsace alone nearly 300,000 tons more than was allowed before the war.

Meantime, as the result of the cutting off of German supplies during the war, there has been a keen quest for other sources of potash. A considerable amount has been, and will continue to be, recovered from the flue dust in cement works. Some has been made from the sea-weed, kelp, but while this and some other sources have been used during the period when potash rose from $40 to $45 a ton up to $400 and $450 a ton, they are not likely to be much in demand when the product drops below $100 a ton. Important deposits of potash salts have been found near the borders of Abyssinia, in the Italian district of Eritrea, and these reached an output last year of 20,000 tons. Deposits also have been found in Spain at Cordova, Luria, and other places, and the brine and salt lakes of Nebraska and California are now worked for their potash contents.

A great future source of potash exists in the feldspar rocks in which Canada is rich, but the chemical problem involved in producing it from this source is yet to be solved on a commercial scale.

On account of the fall in prices, the present is a critical time for potash producers in America. It is reported that 100,000 tons of potash produced in Nebraska are in storage warehouses awaiting sale. The total production from the Nebraska is about 220,000 tons a year, equivalent to 50,000 tons of pure potash; the production of the California works at Searles Lake being about 10,000 tons of "actual" potash. Kelp yielded last year a little over ten per cent. of the domestic production of potash in the United States.

Foreign potash cannot be brought into Canada or the United States in time for this year's use on the land, so that if the existing stocks were freely drawn on it would be better for the farmers in securing greater production and would give a chance for some branches of the new industry to survive. The American War Trade Board announces that no potash from Alsace will be available on this side before June next—and even then the imports are to be regulated by license. By these means it is expected that a collapse in prices will be avoided.

IRON PLANTS HUN-WRECKED.

The commission which has been investigating the iron mines in the rich Briey coal basin, France, report that most of the iron mines are in good condition and can be worked again. The commission find, however, that nothing remains of the gigantic manufacturing plants established at the mines which were destroyed by the Germans, and that they will take years to reconstruct.

The Functions of a Research Laboratory.

A Description of the Internal Organizations and Some of the Successes of the Research Laboratory of the General Electric Company.

By Dr. Saul Dushman.

ONE of the most fundamental lessons which everybody seems to have learned from the experience of the past four and a half years is the need of increasing our efforts in scientific work. Everything bears witness to the existence of a universal idea that somehow or other success in both individual and national effort is intimately bound up with the rate at which that individual or nation assimilates scientific principles and seeks to apply these to his environment.

There is no branch of human achievement in which, in the ultimate analysis, the personal element does not enter, and nowhere is this more true than in industrial research work.

HISTORY OF THE RESEARCH LABORATORY OF THE GENERAL ELECTRIC CO.

On January 1, 1901, the General Electric Company engaged Dr. W. R. Whitney, who was then a professor of chemistry in the Massachusetts Institute of Technology to organize a department of physical and chemical research in connection with their work. The first laboratory was located in a small room, 50 ft. by 100 ft., in one of the older buildings of the company.

The present staff of about 60 college graduates and 200 non-technically trained men and women is located in a modern seven-story laboratory building, and occupies the greater part of four floors and the basement, a floor space of about 66,500 square feet.

Organization of the Laboratory.

In contradistinction with the semi-military and rigid type of organization adopted by other research laboratories, the research laboratory of which Dr. Whitney is director, has a very loose type of organization. Naturally, the machinists, carpenters, plumbers, electricians and millwrights attached to the laboratory are in direct charge of one or two men who see to it that every request for work requiring the aid of these mechanics, is given attention in due order. Then there is also a certain amount of production carried out in the laboratory. Before a new device can be transferred to the factory for a large scale production, there are numerous problems to be worked out both in regard to its applicability, ease of duplication, method of construction and so forth. This necessitates making a large number of these devices, sending them out for trial use on different installations in which they are intended to be used; overcoming causes of failure in actual use, and also developing improvements from time to time as may seem necessary from the reports of engineers who are using the device.

If the demand for the device is not very great, the production may remain in the laboratory for quite a long time. On the other hand, as soon as the demand justifies it, the production is transferred to the factory and the latter must then work out such problems as cheapening of costs and quantity production. Naturally the initial production is ordinarily in charge of the particular individual who is responsible for the new development, but gradually if the work becomes very important from an industrial point of view, other men in the laboratory who have shown particular aptitude in running production work will be given charge of this particular problem, so that the development may be accelerated. Incidentally, this production work furnishes the laboratory with an income which may often amount to a considerable fraction of its total expenses. Furthermore, there is an advantage in an industrial research laboratory in having a certain amount of production going on simultaneously with the more purely research work, in that problems arising during these initial efforts towards production often lead to further discoveries, while the reaction on the research workers themselves of trying to formulate their ideas in a practical form is extremely beneficial.

The most important function of the research laboratory is, however, to evolve new ideas, and the men engaged in this kind of work are directly responsible to Dr. Whitney, and work in close touch with him. While some of the problems may originate with him, the men themselves are encouraged to make their own suggestions and evolve their mode of attack.

I believe that I am quite justified in stating that the success which has hitherto been attained by the Research Laboratory is largely due to the personality and policy of Dr. Whitney himself. He does not make any attempt to domineer the situation and treats the men who work in the laboratory not as employees but as co-workers. The result is that this same spirit extends right down the line to the method of treatment of the humblest individual in the laboratory who sweeps the floors. If one man has particularly good ideas along certain lines and wishes to develop them, he is given assistants who work with him, but not for him, and these assistants co-operate with their leader because he leads, not because he bosses. Furthermore, there is every incentive for these assistants to become leaders themselves as they develop and broaden out in ideas and become more and more independent in their work from other guidance, their work is recognized and encouraged. There is thus no set rules of grades among those engaged in research work in the laboratory. Each man automatically finds himself either in the position of leader or enthusiastic supporter of one who has more brilliant ideas. Aften times men perform both functions equally successful in different lines of work, so that the dividing line is very indistinct, and each individual worker is encouraged to develop his latent abilities to the utmost extent.

Classification of Laboratory Problems.

The problems which form the subjects of investigation in the research laboratory may be roughly classified under three headings.

(1) Intensive.—Firstly, there are the so-called intensive problems. We take a given product and try to improve it. Thus the loss in a transformer core depends upon the kind of steel used for the core. "Even a slight decrease in this loss is of great importance because of the enormous aggregate of transformers in use, most of which have their supply voltage on them twenty-four hours a day, so that their core loss is a continuous waste." For this reason

continuous research on transformer steels seems justified, even though the results seem small. Slight differences in the amount of silicon or other eleemnt; slight variations in method of annealing, the effects of the most infinite number of possible changes in these factors are studied and their results considered from the point of view of their availability in factory practice.

Work on insulation is largely of this nature. During the war a great deal of work was started on porcelain insulation, and the effect of changing the composition of the porcelain on its life in spark plugs was studied. The results so far obtained are very encouraging, and it is hoped ultimately to obtain a spark plug which will not break down.

Under the same heading, we can mention the problem of vacuum tubes for wireless outfits for the navy and army. The design of these tubes was gradually improved so that for both receiving and transmitting purposes the most recent tubes are vastly superior to those which had been made in 1915 and 1916.

(2). Specific.—The second class of problems may be designated as specific. The object sought for is defined perfectly and lines of investigation are started converging towards one goal. Thus, in 1914, immediately after war was declared, the price of magnesium went soaring, and a great demand arose for this metal which is used much in the form of flash-powders as well as for explosives. Text-books on chemistry tell us how to make a small globule of magnesium by electrolysis of the chloride, but it is a far-off evolution from this to the production of the metal in ton lots. Yet the problem was successfully solved and the manufacture of magnesium was developed into a factory scale proposition.

Through the connection of Dr. Whitney with the Naval Consulting Board, it was realized that the laboratory could be of assistance in solving the problem of the submarine menace. Our experience in the design of vacuum tube amplifiers and allied lines led to the development of listening devices by which both the presence and direction of motion of submarines could be detected and the adoption of these devices by the American and allied navies contributed materially towards the elimination of the submarine menace. Some day it will be possible to tell the interesting story of this development in all its details, of how one difficulty after another was successfully overcome and finally not one, but several different types of devices were evolved for detecting the sea-pirates.

As other illustrations of the second class of problems which I have designated as specific, I might also mention a number of other developments. The problem of the gradual wearing out of brushes on electrical machines has been largely solved by the use of a special composition known as Metite. Similarly a bearing metal has been developed which can be used successfully without any oil or other lubricant.

When the U.S.A. entered the war, the General Electric Company had the invidious reputation of being the largest individual consumer of platinum in the United States. This metal in the form of a cone was used in the construction of anode seals of the radiator type of X-ray tube, each tube thus requiring about twelve dollars worth of platinum in its construction. As the government was demanding several hundred of these tubes weekly, it is readily seen that the consumption of platinum would be extremely high. On the other hand, platinum was also required for use as satalyser in the synthetic production of ammonia and its oxidation to nitric acid. It became therefore of extreme importance to develop a substitute for the use of platinum in the X-ray tubes. The problem was finally solved and at the present time practically our whole production of radiator type X-ray tubes has been turned over to the use of this substitute, thus saving the platinum for uses where it is not replaceable by other metals.

(3). Pioneering.—The last class of research problems, and that which I consider the most important, may be called pioneering. By this I mean research work of a purely scientific nature—investigations which aim at the discovery of new facts, new principles, or new points of view. The results of such investigations may be altogether unexpected; they are as it were, gambles on the future; nevertheless such investigations are absolutely vital to the existence of any industry. For no individual, no industry, any more than a nation, can stand still. It must either progress or go backwards, and what makes towards lack of progress is **lack of ideas.** An industry may fail just as badly becuse of lack of new ideas as on account of lack of capital, and of the two failures, the former is the more hopeless.

The day is past when progress in industry could be made to depend upon accidental discoveries. We are realizing more and more with the increasing complexity in our daily lives that "each advance in industrial science must be studied, organized and fought like a military campaign." The ammunition for this kind of campaign is the discovery of new facts. A knowledge of facts is the only sure foundation for any progress in science. And it is furthermore not at all necessary that the search for these facts should be made with the definite view of their possible application. Our past experience teaches us that there is no fact of natural knowledge that does not at some time or other find an application in the course of industrial progress, and we may therefore afford to take this risk with all the assurance that the time and labor spent in so-called purely scientific investigations will be well repaid. As a matter of fact, the whole of our industrial fabric is a voluminous commentary on the practical applications of investigations in pure science.

The history of the Research Laboratory has furnished several illustrations of the immense gain resulting from such purely scientific investigation. During the course of investigations on the cause of blackening in tungsten lamps, Dr. Langmuir became interested in the so-called Edison effect in lamps. In badly exhausted lamps used on a 110 volt or 22 volt d.c. lighting system, there was often observed a discharge between the two leads, due to the emission of negative electricity from the negative terminal. This was correlated with a more general phenomenon known as thermionic emission. All metals when heated emit electrons, or negatively charged particles, and it was argued by a large number of scientists, especially in Germany, that this electron emission is due to chemical reactions between the metal and gas in contact with it. It was shown, however, by Dr. Langmuir and his associates that the electron emission persists even in the best vacua obtainable—in other words, it is a specific property of the incandescent metal.

At the same time that Dr. Langmuir was making a scientific investigation of electron emission, Dr. Coolidge was working on a satisfactory design of X-ray tube that

would be free from any of the bad features inherent in the ordinary tube which operates with low gas pressure. He immediately utilized Dr. Langmuir's conclusion that a heated tungsten filament has a specific electron emission is very high vacua in the construction of an X-ray tube which is much superior in operating characteristics to those previously developed. Further study of the phenomenon by Dr. Langmuir led to the discovery that for any given metal the electron emission per unit area not only has a definite value at each temperature, but is also limited by the field due to the anode. Immediate possible applications suggested themselves and the results were the development of both a high voltage current rectifier and a elay that can be used for receiving and transmitting wireless energy.

All this, let us observe, results from an investigation which had as its prime object the answer to a purely scientific question.

Did this exhaust the possible applications of electron emission in high vacua? By no means. Dr. Hull in our laboratory became interested in the question of secondary electron-emission. When electrons strike a surface, they emit not only X-rays but also secondary electrons. A study of this phenomenon led to the discovery that under certain conditions Ohm's law can be made to work backwards, that is, the **current decreases** as the **voltage increases**, and the relation between these two factors is perfectly reproduceable as often as desired. We therefore have in this case a stable negative resistance, and numerous applications of this principle immediately suggested themselves.

The development of a high voltage rectifier was a problem in which the speaker was engaged for a number of years. At the present time, we have hot cathode vacuum rectifiers (kenotrons) suitable for rectifying currents as high as 0.1 amp. up to 100,000 volts. In working on this problem, we have been led into the investigation of methods of producing very high vacua. Also a device was required to enable us to measure the degree of vacuum obtained in any experiment. At present I can state that we have developed a vacuum gauge of the ionization type by which we can readily measure pressures down to 10-8 mm. of mercury and its lower range is apparently limited only by the limit of sensitivity of the electrometer, so that ultimately we ought to be able to measures pressures so low that there are only 100 to 1000 molecules per cubic centimeter.

The investigation of different phenomena in gases at low pressures has opened up another field of practically unlimited possibilities. The invention by Dr. Langmuir of the half-watt gas filled lamp was a direct result of purely scientific investigations of this kind. From the study of the rate of evaporation of tungsten in vacuo and also in presence of different gases and a simultaneous investigation of the laws of heat conduction in gases at low pressures, Dr. Langmuir not only arrived at the conclusion that it is possible to have a much more efficient tungsten lamp by filling it with an inert gas at a definite pressure, but as a by-product of this work, we have obtained a great deal of information about the mechanism of chemical reactions at very low pressures. For this work in this field, Dr. Langmuir was granted a couple of years ago the Nichols medal and more recently he has been given the Hughes medal by the Royal Society.

These investigations are being continued not only by Dr. Langmuir, but by the speaker and others. The only motive all along in this work has been one of **curiosity.** We may have the hope that the results will be of some practical importance, and, as I have stated before, the results of past experience led us to believe that some commercial applications will result, but what these shall be or along what lines, we cannot foretell, nor do we worry about the impossibility of furnishing an answer to the question.

Just before the U.S.A. entered the war, Dr. Hull was engaged in determining by X-ray spectra the structure of different crystals. This work has led him not only to a better understanding of the exact arrangement of atoms in a crystalline solid, but has also led him to some interesting conclusions about the structure of the atoms themselves. In fact, he believes that it is possible from an examination of the X-ray spectra of different elements to determine the number and arrangement of the electrons in the atoms.

Such a topic of invesigation is surely far removed from the commonly accepted functions of an industrial research laboratory. Yet we do believe that it is quite proper for us to make a study of atomic structure, if only from the point of view of gaining more knowledge.

Now, how can such investigations pay, you ask? Well, let us assume that Dr. Hull could determine the structure of the iron atom in a magnetic state and also those of Heusler's alloys and other magnetic substances, and we could find out why all these substances are magnetic. Surely the results would be of sufficient importance from a commercial point of view to repay the time and money ten times over.

There is another feature in which the policy of the laboratory has been radically different from that of many other places, notably the German laboratories. There is no room for individual secrecy in the laboratory—there are no locks on any of the rooms; indeed almost the only doors in the place are those which open into offices, but very few for the experimental rooms. At the weekly colloquia held in the library, scientific men are invited from all over America to talk about their work and the members of the laboratory staff join in the discussion which follows the lecture. These Saturday morning lectures are looked forward to by all the research men as opportunities for meeting some of the greatest scientists in the country and also getting inspiration from their ideas. To quote a list of the men who have appeared at these colloquia is to give a list of men most of whose names are known all over America.

The laboratory men are encouraged to discuss each other's problems and difficulties; all the men engaged in one field of research work will have weekly or monthly meetings to discuss lines of investigation, modes of attack and other phases of the work. Thus we have a lamp committee; an insulation committee, and also an "electron" committee—consisting of those engaged in problems concerned with electron emission apparatus. This co-operation is to be found all over the laboratory and men in one field of work are continually being aided by the discoveries of new facilities of men in other fields of work. The men are left free to develop more or less along individual lines and the result is that each man who stays in the laboratory for any length of time is a voluntary specialist in certain fields of investigation. I would like to emphasize this

word **voluntary** because it denotes that each individual becomes an enthusiastic in his branch.

Publication of Papers.

Regarding publication, the policy of the laboratory has always been to permit the members to publish their results just as soon as the patent situation would permit, and in the case of purely scientific papers, the results have often been published even before a possible application was suggested. We believe with Dr. Whitney that this policy has been of benefit not only to the Company in securing to itself priority in achievement, but also has given the men an additional stimulus to do the very best work in their power.

The men are permitted and encouraged to attend different scientific meetings at the Company's expense, thus giving them an even better opportunity of receiving broad ideas and stimulation from contact with the most brilliant men of the academic institutions.

Up to date, the members of the Research Laboratory have published over 130 papers, of which over 90 are original contributions, while the rest are resumes and more or less general articles.

I have tried to convey to you some idea of the inner workings of an institution which, as your interest to-night shows, has achieved a measure of success both scientifically and financially. That industrial research pays, both for the company and the men engaged, is a self-evident conclusion from the very fact that the Research Laboratory has grown and is still growing. But I would not wish you to get the impression that the Research Laboratory of the General Electric Co., is unique in this respect. If I had time and more facts at my command, I could convince you that the same broad policy pursued in other laboratories has also been found to yield equally good results. The Research Laboratory of the General Electric Company has merely had the advantage in this respect of being one of the first in the field of industrial research and its success has prompted dozens of other large industrial concerns to follow the same example. Wherever industrial research has been attempted along broad lines and with an intelligent appreciation of the difficulties to be overcome—the results obtained have more than repaid the capital invested and have furnished the strongest guarantee for the future success of the manufacturers.

"The newspapers and popular magazines take a pleasure and pride in pointing to the research laboratories of our industrial organizations as concentrated abodes of highbrows whose daily business it is to invent and devise new appliances and contrivances for the benefit largely of the stock-holder's dividends. Yet nothing is further from the truth. You can not pay men to invent any more than you could pay a Milton to write Paradise Lost or a Reynolds to paint. What can be done, however, and actually is done in the most successful research laboratories, is to produce that environment and idealistic atmosphere wherein men will have free play for their incessant desire for gaining scientific facts, and will feel that joy in living which comes to all those whose lives are spent in the search for and, contemplation of, nature's infinite variety of combinations. Given the proper surroundings, men will rise beyond their fondest expectations and accomplish that which appears miraculous. There is an intellectual satisfaction in a new fact observed, or a new relation discovered that is worth more than dollars and cents."

Now a few words more before closing. The whole world at the present time is in the throes of a reconstruction period which will involve the application of all the ability and power of concentrated effort that each nation possesses. The number of problems to be solved are infinite and their nature extremely complex. In this reconstruction the scientifically trained man is bound to play an important part and the problem therefore before each nation is in what manner the scientists, technical engineer, industrial organization, and national government, can co-operate towards the solution of problems that face the nation.

These questions must be faced and upon their solution depends the measure of success with which a given people may hope to meet the industrial situations awaiting the world from this moment forward..

Address delivered before Society of Chemical Industry at Toronto, February 13, 1919.

THE CHEMICAL ALLIANCE, INC.

It is now proposed to make permanent this very useful American organization. It has been an effective quasi-Governmental agency, assisting the Chamber of Commerce; at the present time, it is busy salvaging the chemicals now in the hands of the Government or under its direction. It is a piece of machinery attached to the industrial whole at a point where it can be of great value and never be cumbersome. It investigates foreign trade situations, world's markets, confers with the Patent Office, sizes up changing conditions and methods, and informs both the Government and the business men connected with the industries involved. England, France, Germany and other countries have such organizations in their boards of trade, and they have greatly assisted conditions by their co-operation during the war. It represents industrial train work and explains why our local Canadian boards of trade, manufacturers' associations and specific industrial groups, banks and Government agencies are often left sadly behind. It is noteworthy and significant that it is called a Chemical Alliance; the word chemical being given its broad, new significance.

BRITAIN PROTECTS DYE INDUSTRY.

Britain has decided to furnish permanent protection for the newly-developed dye industry. The recently announced policy of restricting importation of practically the entire list of synthetic dyes and intermediates capable of being used in the production of dyestuffs is in line with the licensing system introduced some time ago. By the application of this system, the importation of foreign dyes into Great Britain is made contingent on special consuming needs that cannot be satisfied by the domestic products.

POTATO FLOUR INDUSTRY DEVELOPS.

The Canadian Council of Agriculture has given special consideration to the development of the potato flour and hemp industries in Western Canada. The Western Committee of the Canadian Reconstruction Association, the Winnipeg Board of Trade, and the Western Canada Development Bureau have been very active in the matter, and the future progress of both these industries is well assured.

Midvale Absorption Bulb, (Stetser) and Norton Modification, Nesbitt Tube

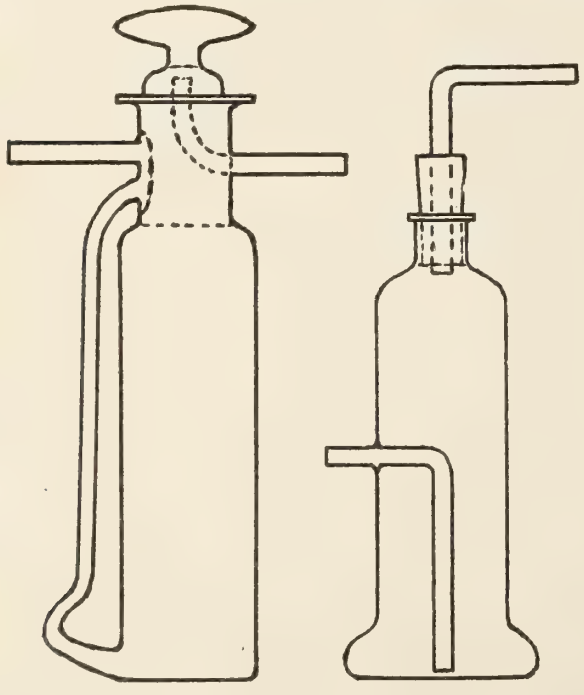
Notes on the Determination of Carbon in Steel

By L. Joslin Rogers

THE development of a new absorbent mixture for carbon dioxide, soda asbestos, has so simplified the apparatus used in carbon determinations that it is quite evident that this material will soon replace all others for this type of work.

Until recently there were practically two types of bulbs, those using potassium hydroxide solution and those requiring soda lime. The great drawback to the first class of bulbs was the inability to permit a flow of gas at a rate sufficient to alow of rapid work required in present-day practice. The introduction of the Fleming tower made possible the seven minute carbon determination. This rapidity led to the application of this method to supplant the inaccurate color carbon in the "snap test" on a heat of steel.

The Fleming tower which has been for the past five years, coming steadily forward on account of its marked superiority over the wet towers has in its turn several features which require most careful attention in order to secure exact results. These are as follows: The soda lime used must be of the proper fineness, and its moisture content must be about 15 per cent. This excess of moisture rapidly consumes the pentoxide in the top chamber, which will accordingly require frequent renewal. Again both the soda lime and the pentoxide must be carefully watched for fissures which will permit the gas to pass through without absorbtion. The weight of the bulb is such that it requires a 200 gram balance to give satisfactory results,



A

A Midvale Absorption Bulb (Stetser and Norton Modification.)

B

Nesbitt Tube.

and naturally this leads to slow weighings. In spite of all these points the tower has steadily gained place, due to its increased functions over the wet towers.

The new absorbent, soda asbestos, eliminates almost every undesirable feature of any combination yet placed in the hands of the chemist for the determination of CO_2 gravimetrically.

The absorbent is sold in granular form about 8 to 10 mesh. It serves as its own drier, no pentoxide or calcium chloride being required. It will absorb nearly 10 per cent. of its weight of carbon dioxide, and can be used while the gas is flowing from 250-300 cc. per minute. The containing tower has a relatively small area and weighs loaded, about 100 grams.

The Midvale bulb modified according to Stetser and Norton is a very simple and inexpensive apparatus, designed particularly for use with soda asbestos. The Nesbitt bulb designed originally for soda lime and pentoxide, serves as an ideal apparatus. This latter bulb was rather a failure for the original purpose intended, since it had only a layer of asbestos between the pentoxide and soda lime, and the top portion of the latter rapidly dried out and became useless. However, this bulb leaves almost nothing to be desired further when used with soda asbestos. One slight turn of the single stopper as seen in the diagram shuts off the bulb entirely from the air. There are no rubber portions to catch foreign material as dust, etc., and the exposed glass area is relatively small. The stopper is large permitting easy filling. The Nesbitt bulb is used with the gas flowing in at the top, and has therefore only a packing of glass wool over the aperture at the bottom. Since soda asbestos is of coarse granular structure, there is no loss of fine particles and the tower never fissures. It is a very satisfactory material also for filling the drying arm in either a Johnson or Vanier bulb.

Another feature which makes the use of either the Fleming or soda asbestos bulb desirable is that both towers will permit of a flow of gas fast enough that a full factor weight of steel may be burned to a fusion without altering the rate. This use of a full factor weight is very desirable from several standpoints. The weight in milligrams between successive weighings gives the carbon content in points. A system of weighing and recording as given in the tabular scheme allows the operator to check the gross increase in tower weight with the total individual increases; thus mathematical errors are detected. These errors on the balance constitute a very high percentage of all errors in carbon determinations.

By the use of a factor weight of steel of the proper fineness a heat is developed which gives a complete fusion of the steel, and a consequently accurate result. Many chemists desire to burn fine thin ribbon-like drillings, believing that they give better results. This is not the case, however, since drillings which are fine and ribbon-like occupy the whole length of the boat and, indeed, it is sometimes difficult to place a factor weight of them on an ordinary boat. Spilling frequently occurs. If there are any coarse particles whatever, these will be left unburned because of the fact that the steel is not in small enough area to permit of development of sufficient heat to fuse the whole mass down.

The idea formerly held that fused steel cinder contained included carbon has been practically discarded by all.

The steel should be fused as completely as though it had been burned with red lead. Caution is necessary, however, that the bedding material in the boats should not contain silica. A silicious bedding, especially where a small amount is placed on top of the steel to prevent "spraying" will invariably cause low results.

When using sufficient heat and steel to effect a complete fusion, the usual clay boats will give but very little satisfaction since they will cut through in sometimes only a few determinations. This adds materially to the cost per determination.

Nickel boats which are among the most durable were for a long time unsuitable because of the high carbon content. This in some material runs as high as 0.20 per cent. Recently, however, sheet nickel one millimeter thick has been secured which has a very low carbon content, and after short treatment in a muffle will give up no further carbon whatever. These are the most suitable and durable boats for combustion of steel where a fusion is desired.

SAMPLE OF RECORD SHEET.

Tabular record for checking results when using factor weight.

Sample No. 0	Time	Tower wt.	Difference	Remarks
Blank		104.6352	% carbon	
No. 1	10.10	.6844	0492	
No. 2		.7219	0375	
No. 3		.7665	0446	
		.1313A	.1313B	

A.—Is the difference between weight of tower at initial point and after third determination.

B.—Is sum of first three determinations.

University of Toronto, Toronto, Ont., March 10, 1919.

SODIUM PERBORATE IN BLEACHING.

In the form known to the trade as "persil," sodium perborate, $NaBO_3$, is largely employed for bleaching cotton and linen goods. A solution of sodium perborate, heated to 140 degs. Fahr., furnishes sodium metaborate and a solution of hydrogen peroxide.

For the bleaching of cotton materials, the cloth is first boiled with a solution of alkasil (which is trade name for silicate of soda), and is then boiled in a bath containing five per cent. of sodium perborate. When bleaching flax, hemp, jute, or ramie, the temperature of the perborate bath should not be higher than 80 degs. Fahr. Bleaching of cotton may also be carried out by concurrent treatments with sodium hypochlorite, sodium peroxide, and sodium perborate. But, owing to the fact that peroxides serve to neutralize the action of hypochlorites, and the latter act on the peroxides to liberate immediately the oxygen bound up in the latter, it is difficult to understand just the rationale of the use of the two bleaching agents together. The same is also true of the mutual action of hypochlorites on perborates. After the use of hypochlorites, the perborate acts as an antichlor, whereby both the hypochlorite and the perborate are mutually neutralized. Straw may be bleached with a solution of perborate acidified with oxalic acid. The bleaching of wool with perborates is done in a solution acidified with lactic acid. In bleaching silk, it is recommended to first wash the silk in soapy water mixed with benzine, which emulsifies the silk gum and fatty matters; the silk is then given a bath containing 5 lbs. of sodium perborate, 20 lbs. of cocoanut oil soap, and 250 gallons of water.

Sodium phosphate is generally employed in connection with the sodium perborate, presumably to increase the alkalinity of the solution without making it caustic, as the bleaching activity through the formation of hydrogen peroxide is much greater in an alkaline solution. It is also recommended to treat the material to be bleached to a previous bath of sodium bicarbonate. This also aids to increase the alkalinity of the bleaching solution. This method has been suggested for the bleaching of artificial silk. Sometimes the sodium phosphate is added directly to the perborate and sold as a special mixture; such, for instance, is "Clarax," which contains sodium perborate, sodium phosphate and borax.

—From The Color Journal, N.Y.

THE ELECTRIC SMELTING OF IRON ORES IN BRITISH COLUMBIA.

The report of Dr. Alfred Stansfield, who last summer made a thorough investigation on behalf of the Government of British Columbia in connection with the electric smelting of iron ores, is now available. The report itself is quite complete and is a good summary in every way of existing conditions.

Much seems to depend, however, on the possibilities of newer methods lowering costs. The method from which much is hoped consists of crushing the ore to a coarse powder, and removing the gangue by magnetic concentration. This is followed by reduction at a moderate furnace temperature until grain metal is produced. This would then be used in the electric furnace for both the production of pig-iron and steel. The electric power needed for the final melting would be less than one-third of that required for smelting the iron ore by existing methods. A similar process has been operated, with some success, by Dr. Trood and Mr. Dorrah, at Heroult, California.

When everything is considered, Dr. Stansfield believes that the British Columbia industry would be successful commercially, but that much would depend on the production of iron and steel of special qualities. Competition with the blast furnace on pig-iron would not be possible. In conclusion, the report states:

"In view of the small demand for pig-iron in British Columbia, it would be almost essential, if a smelting plant is to be established on an economic basis, that additional products shall be turned out. Steel for castings and small rolled sections, and ferro-alloys, such as ferro-manganese, ferro-chrome, and ferro-silicon, could be made suitably in such a plant. These additional products would permit of more economical operation, would enable larger profits to be made, and would allow the plant to continue in profitable operation, if at any time the price of pig-iron were to fall below the cost of production.

"In view of the present situation, it appears advisable:

"(a) To develop one or more of the best iron-ore deposits and to make complete tests of the ore;

"(b) To reserve a suitable water-power for future development;

"(c) To establish a plant for the economic production of charcoal from mill-waste;

"(d) To investigate the new process for the production of electric pig-iron, and if this is found satisfactory to begin immediately to produce pig-iron; purchasing power for this purpose until the water-power can be developed."

Western Coal

The conclusion of a series of three articles discussnig western fuel problems and the means taken by the government officials to stimulate the development of these resources

By Prof. R. D. MacLaurin, Saskatoon, Sask.

IT has been previously pointed out by the writer that sufficient information is not available to substantiate the claims made in the report written by Mr. R. A. Ross on the briquetting of Saskatchewan lignites, and published by the authority of the Sub-committee of the Privy Council for scientific and industrial research. In previous articles on this subject, the following points were discussed: (a) That the national significance of the carbonizing of coal depends on the successful utilization of the by-products, and that the cost of the briquetted residue likewise depends on the same factors; (b) that the proposed substitute for anthracite coal is too expensive; (c) that no reasons have been given for locating the briquetting plant at Estevan in preference to other locations; (d) that such claims as "the most effective way of treating lignite is by carbonizing and briquetting," have not been substantiated by facts; (e) that the limitations of the briquetting process have been overlooked in the Ross report; (f) that the important question of combustion of fuel has been ignored; (g) that no one method of treating lignite will adequately meet all needs for domestic and commercial purposes.

It has been estimated that Western Canada possesses at least twelve per cent. of the world's total supply of coal, including anthracite, bituminous and lignite, but in spite of this fact over 500,000 tons of anthracite are imported annually from Pennsylvania into Western Canada, a distance of about 1,600 miles. The chief reasons advanced by the Research Council for the carbonizing and briquetting of Saskatchewan lignites is to provide a substitute for the 500,000 tons of anthracite imported, in order that the importation may be diverted to Ontario and Quebec. The arguments advanced by the Research Council are based on the assumption that the only satisfactory domestic fuel is Pennsylvania anthracite, and even if this incorrect assumption were admitted, the fact must not be overlooked that there are large deposits of anthracite and high-grade bituminous coal in Alberta, and unless briquettes can be manufactured at a price which will successfully compete with Alberta coal, there is no justification for a large expenditure of money merely from the standpoint of fuel.

The bald statement that over 500,000 tons of anthracite are imported annually from Pennsylvania into Western Canada, and that such is evidence that Western coal is unsatisfactory for domestic purposes and therefore a manufactured substitute for anthracite must be provided, is not sufficient evidence to support the claim. This raises the question as to why Pennsylvania anthracite has been imported into Western Canada for domestic purposes. Some of the reasons are: (a) That anthracite can be burned fairly satisfactorily in most of the furnaces on the market; (b) the railways desire westward bound freight for grain cars, many of which would otherwise be brought to the West as empties; (c) the Western mine operators were supplying the market with run-of-mine coal, which was not as desirable as the graded anthracite for domestic use (This method was forced upon the Western mine operators because their market for pea coal and screenings was limited.); (d) furnaces now on the market are not especially designed to burn coal of high volatile content, consequently Western coal (instead of the furnaces) was condemned.

There are transportation problems involved whether coal is shipped eastward or westward, but as far as coal of good quality is concerned, there is abundance of it and, if proper methods of burning are adopted, quite as satisfactory results may be obtained with Western coal as with Pennsylvania anthracite.

The Research Council has compared the relative value of fuels on a B.T.U. basis, and, although this method has serious limitations, it will serve as a basis of argument. The facts in regard to the quality of western coal on a B.T.U. basis, compared with anthracite and briquettes, as calculated from data given in a report by Edgar Stansfield, Bureau of Mines, Ottawa, are as follows:—

	B.T.U.'s Per Lb.
Crow's Nest Pass, average of 22 samples	12,185
Brazeau District, average of 7 samples	11,247
Canmore-Banff, average of 11 samples	13,241
Mountain Park Area, average of 8 samples	12,838
Yellowhead Pass, average of 11 samples	11,105
Lethbridge-Magrath, average of 7 samples	10,550
Drumheller, average of 8 samples	9,656
Briquettes, Ross' report,	11,500 to 12,000
Anthracite, Ross' report	12,000 to 13,500

It is apparent that the coal from the first four districts mentioned is quite equal in heating units to anthracite coal, therefore it cannot be argued that good coal is not available, and because the general public are not provided with furnaces suitable for burning this coal, it should not be charged that it is not satisfactory for domestic purposes.

Since the coals from the districts mentioned are equal in heat units to anthracite and contain more heat units than lignite briquettes, the question arises as to how they will compete with briquettes at, say, Regina. The freight rate from the most remote district above mentioned to Regina is $4.70 per ton. Assuming that the average cost of mining in the four districts mentioned is $2.50 per ton, then the cost of mining and freight is $7.20, while the total cost of producing briquettes, including freight from Estevan to Regina, is $9.00. Consequently, on a basis of equal heat units, if briquettes were used, there would be a loss of $1.80 per ton. But, the average heating value of the coals from the four districts mentioned is ten per cent. greater than the briquettes, which would mean a saving of at least seventy cents to the consumer, or a total of $2.50 per ton.

Furthermore, compare the cost of briquettes with raw lignite at Moose Jaw. According to Ross' report, briquettes can be sold in Moose Jaw for $10 per ton. This amount is made up of $7 per ton at the plant, $1.50 transportation charges, $1.50 delivery costs, and dealers' profit. On the same basis, raw lignite could be sold in Moose Jaw for $4 per ton; that is, $10 would purchase two and a half tons of raw lignite, or, in other words, two and a half pounds of lignite could be purchased for every pound of briquettes.

The average heating value of one pound of lignite-briquettes is 11,750 B.T.U.'s and the average value of two and a half pounds of raw lignite is 18,500 B.T.U.'s. Therefore, on a B.T.U. basis, lignite briquettes should be sold for $6.35 instead of $10 in order to compete with raw lignite at Moose Jaw. As a matter of fact, lignite, raw, dried or carbonized, can be burned in a suitable design of furnace as readily as anthracite, and furthermore, lignite can be burned without soot, smoke or danger of explosions.

The total consumption of coal in Canada is approximately 30,000,000 tons per annum, and it is generally conceded that 20 to 25 per cent. of the fuel is wasted through inefficient methods of combustion. It is also well known that a large percentage of screenings is wasted, so that a conservative estimate of the waste would be 6,000,000 tons. A problem of preventable waste of such dimensions is worthy of serious consideration from a national standpoint, as efficient utilization of fuel is one of the most imprtant phases of the problem.

The Research Council, in dealing with Canada's duel problem, have ignored the importance of improved methods of combustion and the successful utilization of the large percentage of waste occurring at the mines and have advocated briquetting as the sole solution. This is a very circumscribed viewpoint, and fails to grapple with some of the main issues of the problem. The claims which are made for briquetting lignite by the Research Council cannot be substantiated by facts, and furthermore, no such claims are made by Mr. M. S. Darling, Professor E. J. Babcock, and others who have actually done the investigation work on this subject.

CHEMICAL SOCIETY NEWS

Canadian Pacific Section, Society of Chemical Industry.

The second regular meeting of the Canadian Pacific Section of the Society of Chemical Industry was held on February 24th, at the Vancouver Chamber of Mines. The meeting was preceded by the usual dinner at the University Club. The speaker for the evening was Professor E. H. Archibald, and his subject was "The Rusting of Iron."

Professor Archibald first reviewed the experiments which had been conducted by a succession of scientists to determine the cause of the corrosion or rusting of iron. The contention of one school of investigators was that rusting could not take place without the presence of carbon dioxide, but this has been vigorously contested. The speaker also explained the electrolytic theory which he considered was more tenable than the carbon dioxide theory. With regard to the corrosion of iron in water, it is considered that the most important factor was the depth to which the iron was immersed in water; if an iron plate was placed in water, the upper surface would corrode more quickly than the lower. Rain water, saturated with the impurities of the atmosphere, would tend to make iron rust more quickly. Light also influenced the rate of corrosion, for iron exposed to diffused daylight would rust about three times as quickly as if it were not so exposed.

The rougher the surface of a piece of iron, the more readily rust would form upon it, and once the surface had become rusted, the process would be accelerated. This explains the fact why railway rails which are not in use rust more than those over which trains frequently pass. In the latter case, corrosion was removed from the rails almost as quickly as it formed, which had a tendency to hinder the process.

Montreal Branch.

A meeting was held on Friday, February 14th, with Prof. Evans in the chair. The paper of the evening was given by W. E. Wiegand, of the Canadian Consolidated Rubber Co., Montreal. His subject—"The Study of Fine and Coarse Pigments in Relation to Rubber and Paint"—proved most interesting and instructive. The speaker traced the history of the rubber industry from the earlier crude efforts of the natives down to the modern methods of the up-to-date factory. Some very interesting experiments were carried out by Mr. Wiegand, showing the curing of rubber by heat and by the cold method of immersion in various sulpho solutions. The rubber and paint industries were compared, and common difficulties were pointed out in the choice of suitable pigments. Several slides were shown, illustrating various pigments which enter into present-day rubber manufacture, and illustrations were given of the methods in tree tapping used by the natives in the Para district of South America.

Toronto Branch.

On March 20th, the members of this branch were privileged to hear Dr. W. J. Wilson, of the Mines Branch, Department of Mines, Ottawa, speak on the subject "The Recovery of Potash from Cement Plants." During the last ten years, Dr. Wilson has visited, in the interests of the Government, all the cement plants and plants recovering potash in America. The necessity for soluble potash salts, coupled with the very high price, stimulated some 17 companies to erect plants and install dust precipitating and washing processes. Some 80 lantern slides were shown, illustrating types of construction and the magnitude upon which the operations were carried on. Authentic data regarding the efficiency and feasability of operating these plants under falling market conditions is not available in many instances. Where the plant is situated in a district where it is necessary to treat the gases in order that the property surrounding the plant may not be depreciated, it is likely that potash will remain a by-product. In many cases, however, the expenditure in plant is not likely to be paid for in the near future, if at all.

Some discussion followed the address on the fertilizer situation, and the idea was developed that previous to the war, the German Potash Syndicate had to a certain extent over-stimulated the demand for potash salts. These salts are essential, but no great injury was noticed in average cases where a smaller amount of potash had been used during the past year. It is very necessary, however, that there be no necessity for starving many crops for lack of potash and a cheap price, with big demand, would be very beneficial for many of our crops and soils.

Ottawa Branch.

A meeting will be held on April 3rd, when Mr. Hambly, of Buckingham, will give an address on "The Teaching of Chemistry from the Viewpoint of the Manufacturer."

American Institute of Chemical Engineers, Boston, Mass., June 18th to 21st.

Convention of Canadian Chemists, Montreal, Que., May 16th and 17th.

American Chemical Society, Buffalo, N. Y., April 7th to 11th.

International Mining Convention—Vancouver B., C. March 17th to 19th.

Delegates of the International Mining Convention, Vancouver, B.C., March 17th to 19th. Front of Court House.

The Convention was a psychological bonanza. Over 500 delegates from all ends of the earth were concentrated in Vancouver by the energetic publicity of the British Columbia Chamber of Mines, and as a result, an "entent cordiale" of the mining and other industrial interests of the Pacific Coast has been pledged for the work of reconstruction.

At the opening of the Convention, the Hon. Wm. Sloan, Provincial Minister of Mines, announced the initiation in British Columbia of iron and steel smelting from native ores. He stated there is ore of such quantity and quality as to assure production of 250 to 300 tons of pig iron per day. The support of the Dominion Government is stated to be pledged. Ship-building will, therefore, continue.

Program of Papers and Events.

March 17th, **Morning Session.**—Chairman, A. M. Whiteside, President B.C. Chamber of Mines.

"Mineral Resources of B.C.," Hon. Wm. Sloan, Minister of Mines.

Complimentary Luncheon.—"Industrial Welfare Work." (1) Lieut.-Col. R. W. Leonard, President of Canadian Institute of Engineers; (2) Mr. Buchanan, on behalf of the National Council, Y.M.C.A. Industrial Extension Dept., offered service to the mining industry.

Afternoon Session.—Chairman, Dean Henry Landes, University of Washington.

"Estimated Mineral Production for British Columbia, 1918-1919," Fleet Robertson, Provincial Mineralogist.

"Attractive Prospecting Areas and Promising Ore Deposits," the Resident Engineers in charge of the six Mining Divisions of British Columbia.

Evening Session.—Lecture, "Mining as an Investment," T. A. Rickard, Editor of Mining and Scientific Press, San Francisco. This was a most masterly address, eloquently expounding the fundamentals involved in the success of mining "adventures."

March 18th, Morning Session.—Chairman, S. S. Fowler, Nelson, B.C.

"Gold," H. N. Lawrie, Chairman, Oregon Bureau of Mines, Portland, Ore. The greatest need in the mining industry is substitution of the present stagnation by the immediate preparation for the expansion of trade, which will follow upon the signing of peace.

"Government Control of Smelters," Sidney Norman. Editor of Northwest Mining Truth, Spokane, Wash. The establishment of a smelter for lead, etc., on the Canadian Pacific Coast and Government regulation of smelter rates and payments to ore producers, were urgently advocated.

Complimentary Luncheon.—Rotary Club of Vancouver.

Afternoon Session.—Mr. A. M. Whiteside, Chairman.

"The Better Preparation and Utilization of Coal," (1) G. W. Evans, U.S. Bureau of Mines, Seattle. Improved methods of working an dthemachinery for utilization of fines, as pulverized coal, were described. (1) Francis W. Glover, Princeton Coal & Land Co., Princeton, B.C. Research is necessary in heat treatment and by-products of B.C. coals.

"The Prospector: What He Should Be and How to Encourage Him," J. P. McConnell, Journalist, Vancouver. Local classes of instruction should be established at various centres in B.C., and legislation passed giving the prospector an untransferable proportion of net profits resulting from the development of his discovery.

"Taxation of Mines," (1) Valentine Quinn, Granby Consolidated Mining & Smelting Co.; (2) T. W. Bingay, Consolidated Mining & Smelting Co., Trail, B.C.; (3) Nicol Thomson, Chairman, Mining Committee, Board of Trade. Taxation should be based on absolute net income, allowing for costs of production, depreciation, etc., and should be applied equitably to all industries.

Important Resolutions.—(1) Re-establish old postal rates on U.S. mining and scientific journals; (2) the Departments of Mining and Geology of the University of B.C. be granted more equitable appropriations; (3) Provincial Government institute further exploration of northern B.C.; (4) present fixed price of silver be removed; (5) Department of Trade and Commerce advertise the resources of B.C. by film.

Evening.—Complimentary banquet by B.C. Chamber of Mines, Maurice D. Leehey, of Seattle, Toastmaster.

F. T. Congdon, K.C., of the Yukon, spoke of mining camps as being the real universities of the world, where the qualities of human sympathy, courage and fortitude against adversity were inculcated.

A. C. Garde, of Prince Rupert, emphasized the mineral resources of his district, particularly the large deposits of haematite.

M. J. Carrigan, Seattle Chamber of Commerce, spoke with authority and experience of B.C. iron ores. He was secretary of the old Pacific Steel Co., which used B.C. ore in their Irondale smelter. The salvation and perpetuation of the whole Pacific Coast shipbuilding industry are dependent upon the establishment of local iron smelting. Mr. Carrigan and his associates have spent $80,000 prospecting for iron ores in B.C. There are over 5,000,000 tons in sight on Texada Island, of from 63 to 66 per cent. metallic content and of Bessemer quality. Similar ore abounds at many other points, especially on Vancouver Island. The late J. J. Hill is said to be responsible for the legend that we did not have ore in commercial quantities. Mr. Sloan, the Minister of Mines, has killed this ogre.

The extensive exhibit of samples in the Hotel Vancouver suggested the magnitude of the natural mineral resources of British Columbia.

The display of mining machinery and accessories, include all the latest appliances for the expeditious and economic handling and treatment of ore. Flotation and ore-testing machines were expertly demonstrated by Prof. Turnbull, of the University of British Columbia.

March 19th.—Over 200 delegates were the guests of the Britannia Mining & Smelting Co., at their mine at Howe Sound. This is the largest copper mine in the British Empire, and has some 40 miles of tunnelling. The introduction of oil flotation prevented the abandonment of this mine a few years ago. The ore is chalcopyrite mostly, running 2 per cent. Cu. on mine run basis and $1.00 per ton of gold. The concentrates are smelted at Tacoma, Wash. The size and development of this ore body were a revolution to all.

The B.C. Sugar Refinery was also visited, where a powdered coal heating plant has been substituted for oil burners. This is the first plant of its kind to be operated in Western Canada.

Tribute was paid to the memory of the late Mr. A. B. Clabon for initiating the Convention, and to J. D. Kearns and Dr. Edwin T. Hodge for their large share in its success.

Next year it is planned to hold the Convention in Seattle.

MEETING OF MINING INSTITUTE.

Mining will always be an attractive field for Capital and a continual source of problems for research workers. We have had an organized mining institute in Canada for over twenty years. The annual meeting for this year was held last month at Montreal.

The usual good program was given. The papers given tend to show the lines along which we have been working and the discussion faced the future squarely. It is not surprising, then, to hear papers on molybdenum-chronium, zinc, platinum and manganese copper and the use of pulverized fuel. Canadian mining men have been thinking and working on these special problems during the war period. The new zinc and lead fields of Gaspe in Quebec are likely to be opened up while the platinum prospects in British Columbia are by no means to be forgotten.

Much interest is being taken by leading mining men in technical education and in assisting labor difficulties and gradually it is to be noted that the men connected with many industries in a technical way are finding time to study problems which were never touched upon in their university lecture courses. An exchange of opinions always does good and the occasion of the convention brought out some discussion regarding the relationship of the all embracing Advisory Research Council to some of the activities in which mining men were interested.

Our mining men are coming home from France with high honors in many instances. Some, however, will not return and in memory of all those who went away the convention was privileged to see the unveiling of the "Honor and Service Roll" of the Institute. The names are on bronze doors which when opened disclose photographs. The tablet also contains the records of each man. Brigadier-Genearl W. O. H. Dodds, C. M. G., spoke of the names of heroes as he performed the ceremony of unveiling.

Some very strong men have been connected with the Canadian Mining Institute in the past, but the President elect, Mr. D. H. McDougall, Manager of the Nova Scotia Steel & Coal Co., may be trusted to ably guide the institute through the year as he has guided his own career and the business with which he is connected. Mr. D. B. Dowling is the retiring President.

The report recently issued by the Department of Colonization, Mines and Fisheries of Quebec Province shows that the annual production for the past year was the most valuable in the history of the province. The total value of mineral was in excess of $18,500,000, a gain of almost $2,500,000 over the figures for 1917. In 1914, the value of minerals were $11,732,000. The most valuable mineral produced in the province was asbestos, with a value in 1918 of $9,091,000, as compared with $7,980,000 in 1917. The other minerals, which were valued in excess of $1,000,000, were copper and sulphur ore, $1,319,000; magnesite, $1,016,000, and cement, $3,003,000.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa.

(Notice.—Recent Government publications of scientific, technical or educational value, are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested upon application to the Department of the Government issuing the same).

Department of Mines.

Geological Survey.—Map 164 A. St. John and Kings Counties, N.B. Map 42 A. Duncan Sheet, Vancouver Island, B.C. Map 44 A. Sooke Street, Vancouver Island B.C. Map 115 A. Sheep River, Tphc. 19, 20, and 21, Ranges 2 and 3, West of Fifth Meridian, Alberta.

These are excellently printed geological maps, showing, in addition to the geological formations, many interesting points such as roads, bridges, churches, schools, post offices, etc. To those interested in the districts mapped, these publications will constitute an authentic and satisfactory reference.

Summary Report, 1917, Part F. and Last. 36pp. 1 map. Fifteen pages of this report deal with the Burnt Hill Tungsten area in central New Brunswick on the Main Southwest Miramichi River, and in them the geology of this area where tungsten was found in 1910, by T. L. Walker, is discussed. There is a mine at Burnt Hill working tungsten ores to a small extent, but the roads are bad, and there seems little interest among either the people resident in the district or others. "This seeming lack of interest," says the writer, "appears to be due to the fact that under the mining laws of New Brunswick the right to prospect for the purpose of locating and acquiring certain classes of mineral deposits, has in the case of large areas of the more promising territory, been granted to various individuals. For instance, the exclusive right to search for tungsten ores over a number of blocks of territory, each containing 10 square miles and bordering the Miramichi River above and below the known occurrence of this class of ore, has been obtained by certain interests, but apparently no prospecting work is being carried on."

The other papers in this report are on the following subjects:—

Notes on some fossil plants from New Brunswick.
Investigations in Western Nova Scotia,
Investigations in Nova Scotia.

Department of the Interior.—Forestry Branch. Bulletin No. 67. Creosote Treatment of Jack Pine and Eastern Hemlock for Cross-Ties. 24pp. By W. Kynoch, B.Sc., F. E., and J. A. Codere, B.A., F.E. Contribution from the Forest Products Laboratories of Canada. J. S. Bates, Chem. E., Ph.D., Superintendent. The conclusions drawn from the experimental work are:—

(1) Satisfactory penetration of creosote oil can be secured in jack pine heartwood even when not thoroughly air-dry, by several processes in common commercial use.

(2) By means of the incision method satisfactory penetration can be secured in jack pine heartwood, even when not thoroughly air-dry, in a considerably shorter time and with less preservative per cubic foot than when treated unincised. Further, the penetration is much more uniform in the incised timber.

(3) It does not appear possible to secure a satisfactory penetration of creosote oil in eastern hemlock heartwood even when air-dry, by processes in common commercial use.

(4) Air-dry eastern hemlock heartwood can be impregnated with creosote oil in a thoroughly satisfactory and economical manner by means of the incision method.

(5) Incising timber causes a slight reduction in its strength. This reduction, however, is so slight as to be negligible for all practical purposes and is amply justified on account of the better protection given to the timber, in treatment, as a result of incising.

(6) A thorough trial of the incision method on a commercial scale is desirable especially as results similar to those reported above could almost without doubt be secured in a number of other species in addition to jack pine and eastern hemlock.

Commission of Conservation.

Electric Generation and Distribution in Canada, By Leo G. Denis, B.Sc., E.E. 296pp., 30 plates. 12 diagrams. Paper covers. Six years ago the Commission of Conservation recognized the desirability of making a survey of the power used in Canada, but the work of making such a survey demanded that one phase at a time should be studied. This particular publication deals with electrical power and, according to the writer, the "object of the present report is to show the important place electric energy occupies in Canada and, at the same time, provide the various companies and individuals concerned therewith with information regarding the operation and general conditions obtaining in other places." The report will also serve, in large part, as a general power survey, as, in most cases, t hekind of power used to operate an electric plant in a certain district wil lbe found the most advantageous."

Information for the report was obtained with regard to six groups, namely: (1) hydraulic plants; (2) steam plants; (3) internal combustion engine plants; (4) transmission lines; (5) substations (6) distribution systems.

The information shows that there is a total of 565 electric generating plants in Canada, with an aggregate capacity of 2,107,743 h.p., and supplying not less than 752 distributing systems of varying importance, which cover some 973 places. Grouped according to the kinds of prime-movers, the result is:—

270 Hydro-electric plants aggregating.....	1,806,618 h.p.
201 Steam plants aggregating.....	288,202 h.p.
49 Gas plants (practically all producer gas	8,157 h.p.
45 Oil or gasoline engine plants aggregating	4,766 h.p.
	2,107,743 h.p.

Over two hundred pages of the report are filled with data arranged primarily with regard to the provinces. Under the title of the province all the municipalities using electric power are placed in alphabetical order, and complete information about the power situation in each place is set down after the name, geographical location, and population of the place in question.

The remainder of the book consists of tables in which the data obtained are compiled in summary groups under the six headings referred to above.

The index is complete; the places mentioned are arranged in alphabetical order.

It seems not too much to say that the purpose of the book as set down in the opening pages has been accomplished, and that in this publication the public and the manufacturers and other users of power have a concise and, as far as a reviewer may judge, accurate resume of the electric power situation in Canada.

Conservation.—A four-page monthly published by the Commission of Conservation, for th edissemination of information relative to the natural resources of Canada.

"The Canadian Oyster."—The Commission of Conservation has for distribution a number of copies of Dr. Joseph Stafford's comprehensive report on the Canadian oyster. Copies may be obtained free on application to the Commission.

Department of Trade and Commerce.

Commercial Intelligence Branch. Weekly Bulletins, Nos. 786-788. In adition to general trade notes from the various foreign markets as obtained through the representatives of the Department, there are given each week lists of names of firms desirous of hearing from Canadian exporters in many lines. The whole publication is inetnded to stimulate the export trade.

Post Office Department.

Report of the Department for year ending March, 1918. 104pp., price 10c. Canadian Official Postal Guide, 1919, 620pp. Price 50 cents. Guide Officiel du Service Postal Canadien, 1919. Price 50 cents. (Obtainable on application to the Chief of Distribution, Department of Public Printing and Stationery, Ottawa).

Special Publications.

Atlas of Canada. 124pp., 17 x 12, 80 maps, 64 diagrams, 12pp. statistics, cloth and leather binding, price $3.00.

Debates of Senate of Canada, 1918. (English), one volume, bound, $3.50.

Debates of the House of Commons of Canada, 1918. (English), 2 vols., bound, per set, $5.00.

Statutes of Canada, 1918, $2.50.

Statuts du Canada, 1918, $1.50.

Coal Resources of the World, per set of 3 volumes, with large atlas accompanying, $12.50. This publication which was intended for world-wide distribution, is now, consequent upon the stock on hand and the difficulty in disposing of copies on the continent of Europe, offered at half the original cost.

Parliamentary Debates (Hansard.) Uurevised Edition of the Official Debates, issued daily during the session:

Senate, $3.00 per session; House of Commons, $3.00 per session; Single copies, 5c per session.

Bills, private and public, introduced in both Houses each session, $3.00. Minutes of Proceedings of the Senate, daily, per session, $1.00. Routine Proceedings and Orders of the Day, House of Commons, (daily), per session, $1.00. (All communications regarding the above publications should be addressed to the Chief of Distribution, Department of Public Printing and Stationery, Ottawa.)

The Canadian Patent Office Record. This publication which has previously been issued monthly, is now converted into a weekly, so that inventors, patent attorneys, etc., may be promptly advised of the work of the Canadian Patent Office. The annual subscription is $4.00; single copies, 10 cents.

DR. SAUL DUSHMAN.

Many men trained in our Canadian universities have found their life work in the United States. Our industries in turn have been often directed by men of special training, who looked to "Uncle Sam" for their birth right. Dr. Saul Dushman, however, has three flags to his credit. He was born July 12th, 1883, at Rostov, Russia. In 1890, his parents came with him to Toronto. His career in the city schools and the University of Toronto was in many ways without parallel. He entered the University of Toronto in 1900 with the Prince of Wales Scholarship and ranked for eight other scholarships of the same time. For three

DR. SAUL DUSHMAN

years, the two honor courses—Chemistry and Physics and Chemistry and Mineralogy—were carried, and each year Dr. Dushman stood first in his work. In 1904, a new department of electrochemistry was created and he was made the first Fellow. In this department, he held a lectureship in 1909 and received his Ph.D. degree. For the last six years he has been with the General Electric Co. at their research laboratory at Schenectody. During this period, his work has been in connection with hot cathode devices, high vacuum problems, and other purely scientific questions. Many articles of merit have been presented in the General Electric Review and Physical Review during 1913-1918.

The opportunities for applied research along lines of defence against the enemy during the war were eagerly and successfully grasped by Dr. Dushman.

Dr. Dushman is honored by Toronto graduates in chemistry and physics, and his work has perhaps done more than that of any other single graduate in bringing the chemistry department of this University to the attention of American universities during the last ten years.

LATEST CANADIAN PATENTS.

Process for Softening Water, G. H. Uecke, 188,499, Jan. 28, 1919. A water-softening substance is regenerated by delivering upwards therethrough a rising column of regenerating liquid that is heavier than water, and that is first relatively weak and then relatively stronger in the regenerating substance.

Fixation of Nitrogen, R. M. McKee, 188,363, Jan. 21, 1919. A container having exposed interior walls of an alloy of Ni 60 per cent., Cr 12 per cent., Fe 25 per cent., approx., is used in operating the N-fixation process. The container is durable and resistant and seems to act as a catalyzer.

Recovering Liquids Used for Separating Solids of Different Specific Gravities, A. Nagelvoort, 188,397, Jan. 21, 1919. The sepd. solids are washed in a solvent of the separant, which will not chemically re-act or combine therewith, except to form the soln. Sn Br_2 is removed from solids by washing in liquid CS_2.

Separating Solids of Different Specific Gravities, Adriaan Nagelvoort, 188,398, Jan. 21, 1919. Solids of different sp. gr. are sepd. in a soln. of a bromide and CS_2, then the solids are washed with CS_2, and the excess CS_2 required to provide a separant of the desired sp. gr. is distilled off from the resulting soln.

Three-phase Electric Furnace, F. T. Snyder, 188,104, Jan. 7, 1919. The furnace has two upper electrodes and a bottom control and re-actance is provided in the path of lowest resistance of such unit as to automatically equalize the currents flowing in the different phases of the polyphase system.

Production of Sodium Cyanide, H. P. Eastman, 188,259, Jan. 14, 1919. An alkali earth cyanamid is caused to react with an alkali metal chloride above the m.p. of the latter and in the presence of CaC_2. The CaC_2 prevents foaming and hastens the reaction.

Preventing the Decomposition of Molten Cyanides, Horace Freeman, 188,261, Jan. 14, 1919. A mixt. containing C, NaCl and lime nitrogen is fused in a suitable furnace; the molten product is tapped from the furnace and rapidly cooled in the form of a thin plate or scale. The product contains NaCN, $CaCl_2$, $NaCl_2$, and free CaO.

Electric Induction Furnaces, O. C. Bockman, 188,205, Jan. 14, 1919. In each phase of the furnace is arranged a regulable path for the magnetic flux in parallel with the ordinary flux path in order to regulate each sep. phase of the furnace, independent of the other phases and of the current on magnetic coils.

Calcium Cyanamid, G. E. Cox, 188,260, Jan. 14, 1919. A mass of CaC_2 is heated in the presence of N, the quantity of heat supplied is reduced below that required to fuse a substantial portion of the CaC_2, the reduced supply of heat is maintained until the re-action is self-propagating and the reaction is continued until all the mass is converted into cyanamid.

Metallic Cerium, A. & M. Hirsch, 188,090, Dec. 31, 1918. A cerium salt is prepared and electrolyzed at a bath temp. of about 850 deg. C., terminal voltage 12, and amperage over 200. The temp. of the bath is finally raised to promote the agglomeration of the deposited metal.

Paint, Koppers Co., 188,272, Jan. 14, 1919. A paint having as its essential constituent a colloidal soln. of coal-tar pitch in solvent, naphtha will readily dry to form a smooth, glossy surface. The coal-tar pitch has a relatively low content of free C.

Composite Building Material, E. Viens, 187,899, Dec. 10, 1918. A fireproof resilient building material, composed of Portland cement, asbestos fibre, Ca $(OH)_2$, sawdust and siliceous material, requires a force of 450 lbs. to pull therefrom 2-inch nail driven 1.5 inches therein.

BUSINESS CONNECTIONS FOR CANADIAN EXPORTERS.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, the Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the nubber of the enquiry. The initials, "B.T.C.," indicate British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

466. **Fish, Lumber, Asbestos, Mica and Zinc.**—An important firm in Genoa, Italy, which acts as commission agents, is desirous to open up trade with Canada in codfish, tinned fish, lumber, asbestos, mica and zinc.

467. **Metals.**—A firm of commission agents of Naples.

469. **Metals.**—An important firm of metal merchants in Milan desires connections with Canadian firms exporting minerals, metals and metal alloys.

473. **Alcohol.**—A Manchester firm is open to consider offers of industrial alcohol. Full particulars and prices delivered Manchester must be submitted.

474. **Confectionery.**—A Manchester firm is open to represent Canadian manufacturers of all kinds of confectionery, particularly chocolates and high-class sweets.

477. **Lamp Glasses.**—A firm in Gloucester is prepared to act as agents for a Canadian house manufacturing lamp glasses of all kinds.

486. **Enamelware.**—All kinds of enamelware, as used in house or hospital, required by a firm in Gloucester, Eng.

502. **Enamelware.**—A Cheltenham firm wishes to purchase enamelware.

515. **Limewashing and Spraying Machines.**—A Gloucester, England, firm.

563. **Grease-proof Paper, Vegetable Parchment and Onion-skin Paper.**—A large paper importer in Japan is anxious to receive samples and quotations from Canadian mills manufacturing the above. The usual size demanded on the Japanese market is 20-inch by 30-inch. Large quantities of this kind of paper are sold annually. Samples of the above paper can be seen, on application to the Commercial Intelligence Branch of the Department of Trade and Commerce, Ottawa.

568. **Cereals and Cattle Foods.**—A Liverpool firm.

569. **Canned Fruits, Condensed Milk.**—An English firm.

571. **Linseed Cake.**—A Liverpool firm.

596. **Soda or Sulphite Pulp.**—A Leith firm wants exclusive Scotch agency for easy bleaching pulp.

607. **Corn Syrup.**—A Glasgow importer.

579. **Asbestos Roofing Shingles, Asbestos Corrugated Sheathing and Building Boards.**—A Liverpool firm.

580. **Hemlock Extract, Hides.**—A Liverpool firm.

592. **Rubber Goods.**—An Englishman now in London, who was formerly manager of a large Petrograd rubber factory, is anxious to get into touch with Canadian manufacturers of overshoes and other rubber goods seeking a market in Finland and Scandinavia, and eventually in Russia.

618. **Powdered White Lead.**—An Argentine firm of paint manufacturers would like to receive quotations c.i.f. Buenos Aires for powdered white lead in casks of 250 kilogrammes net weight.

INDUSTRIAL SECTION

Alberta.

Calgary.—Work on the plant of the Alberta Flour Mills, Ltd., in the south-eastern section of the city limits will be pressed forward. Plans have all been laid for this structure, which will cost about $3,500.000. It is possible that a great iron industry may be the first to be passed upon by the newly created industrial branch of the Alberta Government. Action taken at a recent meeting bears directly on the development of the great iron ore bodies known to exist south-west of Calgary. The Dauntless Manufacturing Co., of Redcliff, has already completed a plant for the making of steel and the manufacture of all kinds of steel products.

Lacombe.—Thompson Vulcanizing Works plan rebuilding factory, which was recently destroyed by fire.

Edmonton.—The Swift Packing Co. propose doubling their plant, with an expenditure of $500,000.

Redcliffe.—The Canadian Western Steel Co. have installed a 25-ton, basic, open-hearth furnace in their plant. The plant produces reinforcing steel, nuts and bolts, and other steel equipment.

British Columbia.

Beaver Cove.—A sulphite plant, capable of an output of 200 tons per day, is under construction at Beaver Cove, Alert Bay.

Vancouver.—An oil refinery is to be established by the International Food Products, Ltd., on Industrial Island. The first unit will be commenced immediately at a cost of $20,000.

The plant of the Morrison Steel & Wire Co., on the water front, has been destroyed by fire. The loss is estimated at $150,000.

C. H. Thornblade, president of the Pacific Welding Co., of Seattle, is in Vancouver for the purpose of securing a site to establish a welding plant here, which will represent an investment of between $60,000 and $75,000.

Vancouver.—Great interest is now being taken by the manufacturing lumber concerns in the pending disposal of the large stock of spruce by the Imperial Munitions Board. Official estimates place the net stock on hand at about fifty million feet. When the armistice was signed, British Columbia was producing airplane spruce at a greater rate than the States of Oregon and Washington combined.

The Consolidated Whaling Corporation, of Victoria, B.C., expect to start operating their fleet of eight steam whalers early in April. It is proposed, this year, to operate both the Akutan and the Kyuquot canning plants to their full capacity.

The Pacific Welding Company, of Seattle, are looking for a suitable site in Vancouver to erect a plant for the manufacturing of welding machinery. This concern expects to employ 200 men in the factory and are making an initial investment of between $60,000 and $70,000.

The Britannia Mines have recently discharged some 450 alien enemy employees, as a result of the strong agitation against the employment of this type of workman.

The Temiskaming Mining Company, of the Cobalt district, Ontario, have made the announcement that they have taken over the Dolly Vardon and Wolfe Silver properties. The price paid for these is around $1,350,000. This is one of the largest mining deals to be closed in this province for some years. These mines were owned by American interests, and are situated in Northern British Columbia. The ore reserves of these properties are estimated to have in sight at least two million ounces of silver. The present upward trend of the price of silver, with an assured market, should make these holdings soon become a valuable asset to the province.

In the Nanaimo District, according to the preliminary report of the resident engineer, four new coal mines have been opened during the past year. Three of these are already producing, and the fourth is expected to be a producer early this year. Coal mining is now at the high level mark as regards production, the demand for this fuel is steady, so that the output of coal should surpass any othtr year in history.

There sems to be every likelihood that a deal will be closed between the Foundation Company and the Imperial Munitions Board for the Ogden Paint Plant at Ogden Point, B.C. The cost of this plant is stated to have been $190,000, but it has been offered to the Foundation Company for $60,000.

According to some of the local oil enthusiasts, they predict that this summer will see the start of one of the biggest excitements in oil ever known in the history of North America. Thousands of acres have been leased, for the purpose of oil prospecting, in the Frazer River Valley. Five local companies are already at work and several others are ready to start operations.

Nova Scotia.

New Glasgow.—During the year 1918, Nova Scotia Steel earned about $17 a share net for the 150,000 shares of common stock.

The President of the Nova Scotia Steel & Coal Company states that it is the intention of the company to develop its Wabana mines on a scale that will put it into a position to enter the ore markets of the world. Extensions and improvements to the company's plans, as previously noted, are also to be carried out.

Ontario.

Beachville.—Excavating has started for $15,000 addition to factory for Neilson Condensing Factory.

Belmont.—Canadian Milk Products plans extensive interior improvements costing $10,000.

Carleton Place.—The Hawthorne Mills are progressing rapidly with work on their new picker house, new dye house and other new buildings. The new main mill is a three-storey structure. The company produces blankets, men's hosiery, Jersey cloth, knitted towels and face cloths. Mr. R. Thomson, Sr., is the president of the company

Hawkesbury.—Work will start in spring for foundry and machine shop for United Iron & Machine Co., Ltd., Haileybury.

London.—Construction work is expected to commence in the near future on a new medical department building for Western University, London, Ontario. The plans have been approved by the special building committee of the Board of Governors of the University. Messrs. Watt and Blackwell are the architects.

Niagara Falls.—An organization meeting of the engineers of Niagara district was held here, March 11th, when a branch of the Engineering Institute of Canada was formed, with these officers: President, A. C. D. Blanchard, of Hydro Canal; Vice-President, W. P. Near, City Engineer, St. Catharines; Secretary, Rex P. Johnston, St. Catharines; Executive Committee, N. R. Gibson, Niagara Falls; W. H. Sullivan, St. Catharines; A. J. Grant, St. Catharines; H. W. Balfour, Welland, and H. L. Burke, Niagara Falls.

There is an opening here for a brick manufacturing plant.

Galt.—Goldie & McCulloch Co., Ltd., is exporting marine engines on a large scale, a recent order being for fourteen 600-h.p. engines for the Foundation Company, of New York, to be laid down at Savannah, Georgia.

Ground is being cleared for the construction of a $25,000 factory for the Riverside Silk Mills.

Ottawa.—The W. C. Edwards Co., Ltd., are increasing their capital stock to $8,000,000 prior to establishing a pulp and paper plant.

The Canadian Trade Commission announces that the Greek Government is in the market for 500,000 steel railway ties of 242 lbs. each.

It is stated that India is in the market for 800,000 tons or rails, with angles, splices, bolts, etc., for delivery in 1919, 1920 and 1921.

Port Colborne.—The Canada Cement Co. announces that their plant has commenced operations, the electric power question having been settled.

St. Catharines.—The McKinnon Industries, Limited, which employed between 1,500 and 1,600 workers on munitions, has commenced the manufacturing of gears and differentials for automobiles, also motor car radiators.

Hamilton.—The Canadian Cartridge Co., Ltd., have reorganized their plant for the production of heavy steel stampings, steel barrels and water meters.

Cobourg.—The Douglas Packing Co., of Fairport, N.Y., has purchased from the Imperial Munitions Board the steel plant operated for munitions here, and will erect new buildings and install machinery. The industry will consist of extracting the pulp from apples, to be sent to the jam factories. Cider and vinegar will be by-products. At present, the I.M.B. has a large quantity of nitrate of soda stored in the steel plant building, and the Board will retain the use of this building until market conditions permit of its disposal.

Welland.—Plans are under way for the construction of a $35,000 artificial ice plant, which, it is expected, will be in operation by May 1st next.

Merritton.—It is understood that the financial statement for 1918 of the Riordan Pulp & Paper Company, Ltd., will show plant and property assets, less depreciation, of $7,300,000. Total net assets are around $10,000,000.

Chatham.—The Hayes Wheel Company has entered upon the construction of motor car axles, and aims to complete 9,000 sets during 1919. This is the first time that motor car axles have been made in Canada. Roller bearings and the brake linings are the only thing that will have to be imported.

Guelph.—The Malt Products Company, of Canada, Ltd., are making expansions to their plant.

Flax spinning operations have begun here with the wet spinning of linen yarn up to 60 lea. It is hoped ultimately to spiny arns as fine as 80 lea, and both wet and dry spun tow yarns are expected to be turned out almost immediately. When additional machinery now being manufactured in Britain is set up in the Guelph plant, it is hoped to produce 1,000,000 lbs. of linen yarn a year.

The Partridge Rubber Co. will erect large extension to their factory. Plans have been prepared and tenders will be called shortly.

Walkerville.—The Hiram Walker Metal Products Co., of Walkerville, Ont., have been appointed special Canadian agent for monel metal.

Windsor.—Frederick Kerby, attorney, has announced the incorporation of the Canadian Collapsible Rim Co., which plans to build here immediately.

Georgetown.—Operations at the plant of the Canada Needle Works, Limited, were commenced last month. This new company will manufacture latch needles for knitting machines.

Guelph.—The Guelph Carpet & Worsted Spinning Mills, Ltd., of Guelph, Ont., are building extensive additions to their plant, which, when completed, will make it the largest worsted spinning mill in Canada. The new plant will include a new dyehouse, and the cost of the works will be about $300,000. The new plant is to be in operation before the end of the year. Mr. H. Quarmby is general manager.

Kitchener.—An addition to their factory is planned by the Kaufman Rubber Co., 419 King St. West.

Leaside.—The Canada Wire & Cable Co. are at present preparing to install machinery in their plant for the manufacture of wire cable.

Toronto.—Willard's Chocolates, Limited, will start shortly on the erection of a warehouse to cost $90,000.

The Northern Aluminum Co. are getting out plans for a ten-storey warehouse building on Sterling Road.

The Holden-Morgan Thread Millers, Ltd., has taken out a permit to build a $2,500 addition to factory on Hellingston Avenue.

Quebec.

Cap de la Madelaine.—St. Maurice Paper Co. contemplates erection of $375,000 extension to paper mills and addition to office building. Manager, R. Louthood.

Montreal.—Montreal Abattoirs, Limited, plan the erection of an abattoir costing $150,000.

Three Rivers.—The Wabasso Cotton Co. contemplate building addition to mills. Estimated cost, $300,000.

Sherbrooke.—The Canadian Ingersoll-Rand Company, Limited, has recently absorbed the Jenckes Machine Company, Limited, of Sherbrooke, Que., thus putting them in possession of two plants—the "Rand plant," and the "Jenckes plant." The products of the "Jenckes plant" will continue to be ships' winch engines, structural and plate work; tanks, penstocks; mining machinery and equipment, ore crushers, cars, cages, and pulp and paper equipment, such as barkers, grinders, water wheels, etc. The headquarters of the Canadian Ingersoll-Rand Company are at 260 St. James St., Montreal.

Montreal.—The C. A. Sharpe Company, Limited, who have been manufacturing paint, glass, mirrors, etc., are enlarging their business and have added chemicals, dyestuffs, and

tanners' supplies. Mr. C. A. Sharpe is President and General Manager of the company; Mr. A. C. Wilson, formerly of the McArthur Irwin Co., is Managing Director; J. E. Plamondon, formerly with the Consolidated Rubber Company, is Vice-President; Claude Sharpe, Treasurer, and L. Picher, formerly with McArthur-Irwin Co., is Secretary of the company. The chemical and dyestuffs end of the business is getting nicely started and the firm announce that they are able to fill orders from textile and tanning companies.

A new method of smuggling opium has just been detected by the United States Customs Office at the border, between Montreal and New York. A bag containing forty tins of opium was found in the locomotive of a train. Of late, there has been a great deal of opium smuggled across the border, and the authorities have been told to keep on the lookout for the smugglers. The opium seized was worth $5,000, while another lot taken some time ago was valued at $10,000.

The annual report of the Black Lake Asbestos and Chrome Company for the year 1918 showed profits of $152,512, as compared with $131,680 in 1917. The directors, in their annual report, state that operations in 1918 were hampered by scarcity of labor, but state that they expect a largely increased output in 1919.

As a result of a bursting retort in the plant of the Dominion Glass Co., considerable damage was done to the building and the machinery, while one fireman was slightly injured.

Saskatchewan.

Regina.—Construction work on the new factory of the Coca-Cola Co. has commenced. The plant is expected to be completed and in operation by April 1st.

The erection of a refining plant, at a cost of $1,000,000, at Regina was announced last month by an official of the Continental Oil Co. An option has been taken on a 40-acre site in Regina. The first step will be to install equipment for the distillation of crude oil. Further additions to the refinery will be made as circumstances warrant. Crude oil will be brought to Regina from the Wyoming oil fields.

Melfort.—Saskatchewan Co-operative Creameries, Ltd., will erect a cold storage and creamery plant, costing about $50,000. Site has been purchased and tenders will be called shortly.

United States.

Washington.—Many valuable German and Austrian dye patents have been turned over by the Federal Trade Commission of the United States to A. Mitchell Palmer, the alien enemy property custodian, who now holds them in trust. The Commission has ceased granting licenses for the working of enemy-owned patents. Mr. Palmer, it is understood, intends to sell these patents outright in the same manner in which he is dealing with the rest of the alien enemy property placed in his charge. An American company has been organized to take over several hundred of these patents of various lines.

North Tonowanda, N.Y.—The interior of the Bronze-Aluminum Corporation's plant was destroyed by fire, with a loss of $4,500, covered by insurance. A few hours prior to the fire the building had been sold to an athletic club, who intended to remodel it for gymnasium purposes.

INCORPORATIONS.

Montreal.—Kingdon Mining, Smelting & Mfg. Co., Ltd. Louis Phillippe Crepeau, solicitor, Montreal. Capital, $750,000. General mining, lumber, smelting business.

Montreal.—Canadian File & Tool Works, Limited. Capital, $200,000. Frederick T. Enright, solicitor, Westmount, Que. Chemical engineers, metallurgists, iron founders, manufacturers of files and tools.

Sarnia, Ont.—Doherty Metal Plating Company, Limited. Capital, $10,000. John Doherty, Sarnia, Ont. Metal platers and manufacturers of chemical metal plating solutions.

Montreal.—The Jost Company, Limited. Capital, $50,000. Percy M. Jost, Westmount, Que. Manufacturers and dealers in pulp, paper, pulp-wood and lumber.

Montreal.—The Victory Lighter Co. of Canada, Limited. Francois P. Brais, solicitor, Montreal. Capital, $16,000. Manufacturers and dealers in iron, steel, copper, aluminium; steel and iron founders, metallurgists.

Toronto.—J. E. Hanger, Limited. Capital, $50,000. Joseph M. Bullen, solicitor, Toronto. Chemists and druggists, manufacturers of surgical and orthopaedic appliances.

Montreal.—Senneville Land Co., Limited. Russel T. Stackhouse, solicitor, Montreal. Capital, $50,000. To purchase, lease, develop lands, and to erect factories, stores, houses, etc.

Hamilton, Ont.—John Sweet & Company, Limited. William H. McGuire, solicitor, Toronto, Ont. Capital, $40,000. Goldsmiths, electro-platers, jewellers, clock makers.

Wilkie, Sask.—The Wilkie Machine Company, Limited. Capital, $20,000.

Montreal.—Golden Glow Chemical Products, Limited. Capital, $5,000. Gustavus E. Blaine, manager, Montreal. Manufacturers and dealers in soaps, disinfectants, oils, polishes, chemicals.

Toronto.—Khaki Label Beverages, Limited. Capital, $150,000. George H. Shaver, barrister, Toronto. Manufacturers and dealers of health salts, health beverages, soft drinks and confection and machinery connected with the business.

Guelph, Ont.—The Premier Rubber Company, Limited. Capital, $500,000. Charles L. Dunbar, barrister, Guelph. Manufacturers and dealers in rubber and rubber products.

Vancouver.—Rubber Products, Limited. Capital, $50,000.

Hudson's Hope, B.C.—Glenwood Mining Company, Ltd. Capital, $10,000.

Vancouver.—Premier Gold Mining Company, Limited. Capital, $5,000,000.

Vancouver.—Mainland Oil Company, Limited. Capital, $250,000.

Vancouver.—Cariboo Gold-Platinum Extracting Company, Limited. Capital, $250,000.

Vancouver.—Sodium Sulphate Company, Limited. Capital, $50,000.

Vancouver.—Olivine Mountain Platinum Syndicate, Ltd. Capital, $10,000.

Ideal Iron Works, Limited. Capital, $25,000.

Montreal.—The Shawinigan Engineering Company, Ltd. Capital, $100,000.

Stellarton, N.S.—Manchester Iron Mines and Railway Company, Limited. Hugh A. Hattie, agent, Stellarton, N.S. Capital, $75,000.

EXPORT OF CANADIAN GLASS.

As a result of the rather quiet state of the Canadian market for glass just now and the great demand for that product in Great Britain and France, Canadian glass manufacturing plants have developed a large exporting business to these countries. During the week of March 10th, 1919, 120,000 square feet of window glass, approximtaely three acres, were shipped from Canada to Great Britain. In the past, Canada has imported glass heavily, principally from Great Britain and Belgium, and then during the war with these sources closed, from the United States. But to-day, the large glass plant at Thorold, Ontario, has become a strong factor in the Canadian market, one that is likely to become stronger as time goes on. The plant at Thorold is owned and operated by the English firm of Pilkington Bros. The return of many of this plant's most skilled craftsmen from overseas fighting service in the near future will greatly increase the present output. In ordinary times, it would be impossible to produce glass in Canada for export to Great Britain, in competition with British product, but stocks of glass are low at present in England, due to the fact that as many as half of the glass works employees in England have been engaged on the production of dry plates for aerial photography, not only for England, but for the French and American air forces as well. The great quantities of glass destroyed by air raids was another factor in reducing England's supply. The recent reductions in ocean freight rates on glass has made it possible for Canada to export glass to Great Britain, something heretofore impracticable.

ARTIFICIAL SILK OUTPUT MUCH LARGER IN 1918.

Production of artificial silk from cellulose from wood pulp through the action of chemicals by which the wood pulp is turned into a substance almost exactly identical with that carried in the body of the silk-worm is increasing very rapidly. This artificial cellulose is turned into silk threads by being pressed through minute openings in metal plates, falling into a liquid which solidifies the thread.

While the textiles thus made from the artificial fibre are not yet fully equal to those produced from the natural silk, the growing use of the artificial product is illustrated by the fact that United States imports of artificial silk, chiefly in the form of yarns or threads, have aggregated about $30,000,000 in the last decade. Those prior to the war were drawn chiefly from Great Britain, Germany, Belgium and France. With the opening of the war, the supply was materially reduced, so that the quantity of artificial silk yarn imported fell from 2,759,000 lbs. in 1914 to 293,000 in 1918. This fall off in the artificial silk available in other parts of the world so stimulated American production that it advanced from 320,000 lbs. in 1914, the year in which the industry was established in that country, to 6,500,000 lbs. in 1917.

CHEMICAL INDUSTRIES AT PORT HOPE.

There are two relatively new companies located in this little Ontario town. In 1914, the Cosmos Chemical Company began operations in a very small way, producing amyl acetate and refining fusel oil. They have a small nitrating plant for treating their own cotton. During the lats year, the business has expanded and in future should put Port Hope on the chemical map of Canada. The products now made are amyl acetate, refined fusel oil, lamp colorings, leather dopes, bronzing liquids and lacquers.

In a four-storey plant, centrally situated, the Allied Drug Co., a newly-formed manufacturing concern, are now in a position to place on the Canadian and American markets a line of pharmaceutical preparations, prepared foods, and certain C. P. salts, chiefly iodides and nitrates The plant is designed to accommodate about 75 employees. Both these plants indicate what new interest capital is taking in bringing to this country many smaller industries which in time should not only be able to place their products on our home market, but become factors in our export business.

BRITISH DYE FIRMS AMALGAMATE.

When the amalgamation is completed of the two large British dys manufacturing concerns—British Dyes, Ltd., and Levenstein, Ltd.—England, it is assured, will be in a better position to make herself independent of German dye concerns. The amalgamation is now practically consummated, there being only left the joining of the two concerns under one name, a detail which will, no doubt, soon be executed. For the present, the firms will continue to exist separately, but under the changed descriptions of British Dyestuffs Corporation (Blackley), and the British Dyestuffs Corporation (Huddersfield). Eventually, the two names, it would appear, will be transformed to that of the British Dyestuffs Corporation. Neither of these great progressive firms had reached the stage of fulfilling all that the German companies were able to supply, hence the amalgamation. The Board of Trade has taken an active interest in framing details satisfactory to the directors of both firms.

POWERS OF TRADE COMMISSIONERS.

The Senior British Trade Commissioner in Canada and Newfoundland (Mr. G. T. Milne, 367 Beaver Hall Spuare, Montreal) has been notified by the Imperial Department of Overseas Trade in London that he is empowered to appoint an expert to examine and report upon consignments of goods from the United Kingdom, in respect of which a dispute has risen, and to certify the signature of such experts as authentic. The Commissioner will, however, only intervene when requested to do so by both parties to the dispute.

The kind of disputes in which the Commissioner may intervene are those regarding goods which are alleged to be not up to sample, or which have arrived in a damaged condition owing to faulty packing. The Commissioner is not authorized to deal with claims under insurance policies for goods damaged during the voyage.

INDUSTRIAL CATALOGUES.

Shawinigan Magnesium.—Under this title the Shawinigan Electro-Metals Company, Montreal, have prepared a very interesting little booklet for distribution. It deals with the properties and uses of magnesium in industry as far as now known. Under foundry practice are recorded the methods or working with aluminum, copper, brass, bronze, nickel, monel metal and some of the properties of the alloys. Under Physical and Chemical properties useful data are listed. A discussion of the properties of specific alloys of magnesium and a table of comparative costs completes a pocket booklet which is to be recommended for the way in which simple facts are well put.

E. Wade Wilton & Son, Bramley, Leeds, England.—"Anti-Hydro Black Waterproof Enamels. Butimen Solutions. Application on bridges, battleships, collieries, roofing, discussed and illustrated.

UNITED STATES GASOLINE PRODUCTION.

Among the many things upon which the question of victory rested, the production of oil should find a high place. Everything is linked together, and, therefore, many factors were equally essential. Activities on land and water, as well as in the air, demanded unprecedented quantities of oils and, in particular, gasoline. Increased United States production was of great value. The Bureau of Mines estimates that in 1916 the United States was producing fifty million barrels. In 1917, this was raised to sixty-eight million barrels, while in 1918 a peak was reached at eighty-five million barrels. The exports to the allies during this period went from 8,473,102 barrels in 1916 to 13,312,508 barrels in 1918.

FURTHER REMOVAL OF TRADE RESTRICTIONS.

The British Trade Commissioners at Montreal and Toronto are informed that the following goods of special interest to chemical and metal trades may be exported without license:—

Iron and steel manufacturers generally except high-speed steel and a few special articles; machinery of all kinds except textile machinery, and machinery wholly made of brass or copper; barrels and casks, boilers, chrome ore, chesnut extract bark, fuel economisers for boilers, gold beaters skin, glue stock, dry white lead, hide clippings, resins, lead coated sheets, parafin, wax, cats iron pipes, iron and steel wire, wire rope, quebracho extract, solid glucose, silk products, spirits except whisky.

A CEMENT CAR.

The first re-inforced concrete freight car ever built was delivered March 9th to the Illinois Central Railroad for operation in its coal service. The car is light its walls being 1 1-2 inches thick and the floor 2 1-2 inches thick. It has been tested for a capacity of 100,000 pounds.

DEVELOPMENT OF B.C. STEEL.

In a letter, recently read to the Central Iron Committee, at Victoria, from C. H. Gage, F.R.S.S., of the American Finance and Guarantee Co., Chicago, Mr. Gage stated that the ores of Vancouver would produce a high grade of steel, and in offering to investigate the possibilities for establishing rolling mills, he stated: "The refractoriness of the ore on this island is a fallacy, and it is not necessary to import hematite ore from China or any other place to manufacture steel from island minerals."

The Hon. Wm. Sloan, Minister of Mines for British Columbia, is seeking authority from the Provincial Legislature to start experiments with B.C. iron ore for the production of pig iron. It is hoped to thereby encourage the development of the magnetite iron deposits of the province and eventually establish an iron and steel industry.

PERSONALS.

W. F. Geddes, B.S.A., formerly assistant chief chemist for the Aetna Chemical company at Drummondville, Que., is now engaged with the Kellogg Toasted Corn Flake Company, London, Ontario, in research work on cereals.

Captain Frederick Charles Mechin, B.A.Sc., '14, Applied Science, University of Toronto, returned to his home at Brougham, Ont., February 28th last. Captain Mechin enlisted in November, 1917, and after serving in the Mechanical Branch of the Canadian Forestry Corps, was appointed a consulting engineer to the British Admiralty. Prior to enlistment, Mr. Mechin had charge of the building of the Imperial Oil Company's refineries at Quebec and Montreal.

Mr. George C. Mackenzie, who for the past nine years has been in the employ of the Mines Branch at Ottawa as Chief of the Ore-dressing Laboratory, has severed his connection with the Government, and is now with the Electric Steel and Engineering Co., at Welland, Ont., as their general superintendent. Previous to his departure for his new field of work, Mr. Mackenzie was made the recipient of a very handsome mahogany clock, a token of the esteem in which he is held by his colleagues of the Mines Department.

Colonel W. R. Lang, former Director of the Chemical Laboratories of the Faculty of Arts, University of Toronto, has returned from Halifax to Headquarters Staff, Military District No. 2, Toronto.

F. G. Wallace, of Pittsburg, has been elected president of the Canadian Locomotive Co., to fill the vacancy caused by the death of Dr. J. J. Harty. J. L. Whiting succeeds Mr. Wallace as Vice-president.

On Monday evening, March 3rd, Colonel Eben. Carnegie, President of The Electric Steel and Metals Company, Ltd., and managing director of Electric Steel and Engineering, Ltd., invited the staff to dinner at the New Dexter Hotel, Niagara Falls, Ont., to meet Mr. Geo. C. Mackenzie, B.Sc., who has been appointed General Manager of the Company. During the evening, Col. Carnegie announced that, though he was resigning from the active management of the company, he was still to remain a director of both companies, and hoped to visit Canada from time to time.

Manufacturers and business men throughout Ontario heard with deep regret of the death in New York of Henry Louis Frost,president of the Frost Steel & Wire Company, Hamilton Ontario. At the time of his death, Mr. Frost and family were visiting in New York, when he was stricken with Spanish influenza. He was the founder of the business which bore his name.

Mr. James Richardson Donald, who for the past two years has been in charge of the inspection of explosives for the Imperial Ministry of Munitions, has returned to his old firm, Messrs. J. T. Donald & Co., chemical engineers and consulting chemists, Montreal and Toronto.

Laurence Morris Lambe, well known scientist in the Dominion public service, and author of numerous valuable scientific reports and papers, died at his home, 226 Argyle Avenue, Ottawa, March 12th, from pneumonia. As vertebrate palaeontologist of the Geological Survey, he built up the splendid exhibit of the remains of extinct dinosaurs in the Victoria Memorial Museum. In 1901, he was elected to the Victoria Memorial Museum. In 1901, he was elected a Fellow of the Royal Society of Canada. His loss will be keenly regretted by a Dominion-wide circle of friends.

Mr. S. T. Matsuda, of the firm of Tsuda & Co., steel merchants of Osaka, Japan, accompanied by electrical and mechanical engineers of the firm, Messrs. T. Kahayslai and N. P. Onoda, visited Toronto recently and are investigating steel and iron conditions.

The death of the late Hon. W. J. Hanna, president of the Imperial Oil Company, has removed one of the most active figures from Canadian business life. Only a few weeks before his death, he publicly outlined the steps his company would take in building extensions to their Western Canada business. His death will be sincerely regretted by hundreds of business friends throughout the Dominion.

In memory of his son, Sydney, who was killed in action during the closing days of the war, Mr. A. J. Hodgson has given two exhibitions to McGill University. One of the

value of $125 is tenable in the first year of Arts, and the other, to the value of $300, is available to the Science students.

During the past month, the Vancouver Chamber of Mines have continued their series of lectures on subjects of general interest to the public and mining fraternity. On February 7th, Mr. Charles Camsell, F.R.G.S., head of the Geological Survey of British Columbia, lectured on "Quicksilver Deposits of British Columbia and the Yukon." Dr. Dolmage, of the Dominion Geological Survey, on February 13th, gave a lecture on "Oil Geology." The speaker dealt with the character of oil, where it is found, oil strata structure, world production, future supply, oil shale and gasoline substitutes.

Under the auspices of the Engineering and Technical Institute of British Columbia, Dr. D. McIntosh, of the University of B.C., gave an address, this month, the subject being "Electricity, as Applied to the Refining of Metals." The speaker traced out the progress and improvement of the electrolitic processes for the recovery and refining of lead, zinc and copper, and many of the rarer metals.

BOOK REVIEWS.

Statistical Year Book of Quebec, 1918. Bureau of Statistics, Quebec, pp. 565.

This is now the fifth year that this province has produced such a record of its growth. One of the very important points which many other Governments should copy is that the report is dated January 8th, 1919, and was in the hands of the public very shortly afterwards. It is a pleasure to see such speed on the part of a King's printer.

A summarized complete history of the province is given in the introduction, covering 98 pages. Every phase of industry and social life has its place in this record for 1918. The forests, mines, and water powers of this portion of Canada are of special interest to the chemical and metallurgical world.

Coal Tar Dyes and Intermediates. E. de Barry Barnett. Bailliere, Tindall & Cox, No. 8 Henrietta St., Covent Garden, London, XVIII.+213opp., 10s. 6d. net.

The author takes but very little time in getting right into his subject. This marks the book from the beginning as a practical effort to place on record facts connected in such a way that technical men will be interested and assisted. The subject matter is divided into two parts, each division being again subdivided into sections or chapters. Part I. deals with the manufacture and use of intermediate compounds and covers the various organic processes by which these are developed. The second portion deals with the main classes of coal tar dyes, and covers their production as carried out in larger factories.

The author is of the opinion that the sixty-two years of development which has placed 1,500 synthetic dyes on the market will now be followed by research directed towards the production of fast colors at a moderate price. So far, it has been generally true that fast colors have been much more expensive than fugitive ones.

PART I.—Intermediates.

Section 1.—Nitration. The large scale production of nitro products of benzole, toluol, xylol, naphthalene, the nitration of phenols, is taken up and valuable pointers given on apparatus and control of reactions.

Section 2.—Amidation. All three types of amino compounds are taken up and the three technical methods of introducing the amino group into the nucleus are covered in some detail under following heads: (1) The reduction of the nitro (and nitroso) compounds; (2) reduction of the azo compounds; (3) displacement of hydroxyl group.

Section 3.—Sulphonation. Procedure in benzene and anthraquinone series is given and along with technical methods for the formation of many important sulphonic acids.

Section 4.—Hydroxylation. The production of phenol, cresol, resorcinol, alpha-naphthol, and a number of naphthol sulphonic acids and amino derivatives is described in some detail. The handling of caustic melts is described.

Section 5.—Miscellaneous Intermediates. Chlorine compounds which have found some application are described—chlor benzole, benzyl, benzal chloride, and benzoyl chloride—with factory practice.

PART II.—The Dyestuffs.

Section 1.—The Nitroso—Dyes.

Section 2.—The Nitro—Dyes.

Section 3.—The Azo—Dyes.

Section 4.—The Diphenylmethane Dyes.

Section 5.—The Triphenylmethane Dyes.

(1) The malachite green group; (2) the Fuchsine group; (3) aurines or Rosolic acids; (4) the phthaleins and Rhodamines.

Section 6.—The Indamines and Indophenols.

Section 7.—The Azines. (1) The eurhodines, (2) the azonium compounds. Excellent descriptions are given, with structural formulae, illustrating the reactions discussed.

Section 8.—The Oxazines.

Section 9.—The Thiazines.

Section 10.—The Indigoid Dyestuffs. Both the indigos and thioindigos are taken up.

Section 11.—The Anthraquinonoid Dyes. Under Mordant dyes, alizarine is described as the chief. Both acid and vat dyes are taken up, along with many smaller groups naturally coming under this heading.

Section 12.—The Quinoline Dyes. Cyanine, quinoline red, and quinoline yellow.

Section 13.—The Acridine Dyes.

Section 14.—The Sulphur or Sulphide Colors.

The general principles underlying the manufacture and use of this most imported class of dyestuffs are outlined. Methods for diazotization and coupling are given. Under different headings, various sub-groups are taken up, such as direct cotton colors, basic azo dyes, ice colors, developed colors, stilbene dyes and thiazole azo dyes.

Following the subject matter proper is a short account of the dyestuff situation in England. This was introduced, but a very few months ago and covers conditions up to the end of 1918. The author has not been restrained apparently by any commercial relationships when sizing up future prospects. The danger of a world combine is pointed out and some discussion is made of British Government proposals.

The book belongs to a series dealing with branches of industrial chemistry and each number as it comes out shows evidence of having been written with a free hand by an author who is able to combine the practical with the academic quite at will.

The volume is useful, full of concise information, exceedingly timely and reads well indeed. For the advancing student of organic chemistry, the book brings methods of large scale operations and summarizes most completely our present technical knowledge of the subjects treated.

Chemical, Oils, and Metal Markets

The quotations below represent manufacturers' and wholesale importers prices at Toronto, Montreal, or other Canadian points.

CHEMICALS

The conditions of uncertainty and irregularity that obtained in the Canadian chemical market, and the American also, last month have been relieved to a considerable extent during the past ten or fifteen days. While prices have remained at practicallythe same levels in almost all the lines of chemical product's yet the tendency downward is noticeable, to some extent at least, in certain lines. Acids seem to be a little easier and manufacturers are inclined to ease off their acid prices in order to make trade conditions better. The factor of second-hand material "butting in" on the regular market still obtains, it is not yet wiped out, but is fast going into oblivion. One active Canadian manufacturer predicts that the doom of the second-hand chemical dealer is near at hand, and it may be said that signs of the times seem to indicate and justify this chemist's opinion. It will be good news to every manufacturer when he knows that this record-hand material no longer breaks into the regular channels of supply and demand of chemicals. The Imperial Munition Board still has on hand quantities of various chemicals either as crude materials or finished products. These are, however, not being unduly thrust upon the market.

ZINC OXIDE.

The price of zinc oxide has dropped, an announcement to this effect having been made in March 26 by the New Jersey Zinc company. The new schedule of prices show a drop of from one to two and one-half cents per pound, and will apply during the second quarter ending June 30.

Paint manufacturers, who were deprived of lead-free zinc oxide as a pigment in making paints during the war, will find this grade available hereafter, according to the announcement, as lead-free oxide made by French process for use of paint makers can now be furnished. It is used in the better grades of paint of domestic manufacture. Lower prices were also named for those grades of zinc oxide used in automobile tires and in other rubber goods in which zinc forms part of the composition.

CEMENT.

Comment has been made that the cement industry in Canada will experience heavy competition from United States sources during the next few years. Large supplies on hand in the United States are liable to lead to the dumping of them on the Canadian market at almost any price. There is a probability too that the United States Steel Company will go in for the production of cememt on a large scale at their plant at Ojibway when it gets in operation in the course of a year or so. There was some disappointment expressed on the Toronto market over the showing of decreased profits by the Canada Cement Company in their annual report for 1918 as compared with that of 1917. Some brokers are of the opinion that the company did not make money out of its munitions in 1918 and that would explain the $1,150,000 allowed in the report for "depreciation and special equipment written off."

THE ENGLISH MARKET.

Canadian exporters now find that the shipping situation across the Atlantic is much easier. There are now over 200 representatives of Canadian exporters in Great Britain. The recent edict of the British Board of Trade that only goods of British empire origin shall be exempted from the rigid general restrictions imposed during the war is of great import to Canadian manufacturers and producers "who," states a cable to the Canadian Trade Commission, Ottawa, from England, "should comprehend the importance of the fact that foreign goods cannot, therefore, reach England, by way of Canada. The market here is now being opened and, Canadian manufacturers have a big opportunity as stocks in everything are very low."

URUGUAY MARKET.

Shippers of chemicals to Uruguay should note that the order of the Uruguay government of last year calling for the marking of the net contents or weight on all sealed wrappings, cans, boxes, bottles, demejohns, etc., has been superseded. Further decrees on the matter are daily expected, however, such as modifications to the former order.

OILS

There has been no change to speak of in the oil trade during the past month. Business continues fair. The Imperial Oil Company are erecting sales stations at several Western points, which is indicative of the confidence oil men generally have in the future of the oil business in Canada. In the American markets it is believed that the price of gasoline will advance in the next two or three months. Reports of many U.S. oil companies for 1918 show the highest percentage of earnings on record, several of the large companies earning more after taxes than they cleared before paying their taxes in 1917.

SOAPS.

There has been increased activity in the soap trade during the past few weeks. A few days ago a large shipemnt of soap was exported from Canada to Holland, that country, on account of war conditions, being very short of soaps. This export trade has helped the Canadian business to no considerable extent.

EXCHANGE MARKET.

A chaotic condition has arisen in the British and French exchange market during the last ten days. At one time, a man could find some bankers who were bidding for sterling exchange more than other bankers were offering it at, and thus make a profit between specialists. The market for both francs and and sterling has shown a large decline since the time that banking support was withdrawn from the market for each of them. Prior to ten days ago, there were permanent bids in the market for all French or British exchange offered below certain figures, thus artificially keeping rates at a point that the treasury officials of France and Great Britain considered best for the credit of each country here. As a result of the decline in foreign exchange, the American dollar has risen to new high records in nearly all countries. Although Canada is more affected by money conditions in the United States than elsewhere, the rise in the value of the American dollar in Canada during the past week was undoubtedly in some part due to the fall in the value of the British pound sterling in the United States.

METALS.

Some large independent steel manufacturers in the West are said to be confident that the steel industry of the United States will operate in 1919 at an average of between 68 and 70 per cent. of the 1918 production. This may sound like a rather drastic reduction but in reality it would mean an output equal to that of any year prior to the war, excepting 1912, when 30,300,000 tons of steel were produced. During the three years 1916, 1917, and 1918, the average steel production of the United States was slightly more than 42,000,000 tons.

Speaking to the steel men in New York city, March 7th, Judge Gary, Chairman of the United States Steel Corpoation, who has been known as an optimist during recent dull days, said in part, "It is my opinion, and I believe the opinion of most of the large number of men who are assembled here, that since the armistice was signed the iron and steel trade, generally speaking, has been better than it was represented to be in some of the publications—that, all things considered, we have no reason to complain, and that the number of unemployed has been much less than one would suppose from some of the statements which have been fairly circulated."

The recent reductions in American prices has greatly helped to stimulate construction and the end is a step towards successful normal trade.

COPPER.

The recent arrangement made by the United States government, whereby they have agreed not to unload the large supply of copper which they have on hand, following the cessation of hostilities, has had the effect of putting a buttom under the copper market which was badly needed. It is expected that

the present price of 15¼ cents per lb. (New York), or 17 cents, Toronto, will hold. A week or so ago the price of copper dropped as low as 14½ cents per lb. in New York. The U.S. government has 100,000,000 pounds of copper on hand, but this will be sold in small instalments over a long period.

The mining industry and the metals market in British Columbia are at present going through their transition period of reorganization caused by the necessity of readjusting the conditions of labour. Many of the producing mines are finding it exceedingly difficult to carry on under the present economic relationship of capital and labour.

In British Columbia the position of the copper producers is particularly serious. There is practically no market here for copper at present. Copper is the leading product, in value over all the other metals, produced in the province. The mining of this mineral gives employment to about three-fifths of the total number of men utilized in the metals mines.

ASBESTOS.

Present prospects in the asbestos industry are that the trade will experience as good a year in 1919 as in 1918. Demand for asbestos is steadily increasing, though scarcity of ocean tonnage is holding up the filling of orders from France and Belgium. There has been a strong demand for asbestos from France and Belgium, though orders from the latter country are of shareholders of the Asbestos Corporation of Canada), owing, it was said, to the doubtful finances of that country. It is expected that the Belgian government will adopt some method of protecting Canadian exporters in this regard.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	1.00
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	.24—.27
Aspirin, in 100-lb. lots	Lb.	1.75—2.00
Alchohol, grain, bbl., duty paid	Gal.	8.75
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.12—.14
Ammonium Carbonate	Lb.	11—.20
Ammonium Chloride	Lb.	15—.20
Benzoic Acid	Lb.	1.75
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per Ton	$30—$35
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	04½—.05
Chloroform	Lb.	.65—.99½
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.5
Glycerine, drum, C. P.	Lb.	.22
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¾—.04½
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Potassium Bromide	Lb.	—.75
Potassium Nitrate, kegs	Lb.	.28—.30
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	.75—.90
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.16—.18
Sodium Benzoate	Lb.	1.60—1.75
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bichromate, bbls.	Lb.	.18—.19
Sodium Nitrate	Lb.	.18—.19
Sodium Nitrate, refined	100 Lbs.	7.75—8.50
Sodium Nitrate, crude, 95%	100 Lbs.	5.25—5.75
Sodium Cyanide, bulk, 98-99% in cases	Lb.	.35—.40
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground....ground	100 Lbs.	2.75—3.00
Sulphur, roll	100 Lbs.	4.25—4.50
Sulphuric Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphide, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.80—.90
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06½
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	—10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.....
Cobalt, metal	Lb.	—2 50
Cobalt Oxide, grey	Lb.	—1.65
Copper, casting	Lb.	—.17
Copper, electrolytic	Lb.	—.18
Copper, electrolytic, in car lots	Lb.	.17
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.07
Lead, in car lots	Lb.	06⅜
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.01⅛
Spelter	Lb.	.09—.09½
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Steel, mild	100 Lbs.	—5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 guage	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.33
Motor Gasline (service stations)	Gal.	—.36
Lighting Gasoline	Gal.	—.41
Naphtha	Gal.	—.32
Coal Oil	Gal.	—.19½
Fuel Oil	Gal.	—7.70
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	35 to 40c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 35c	per gallon
Dip Oil, 20 per cent.	35 to 40c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Balls	10½ to 11½c	per pound
Naphthalin Flake	8½ to 9½c	per pound
Alpha-Naphthylamin	50 to 55c	per pound

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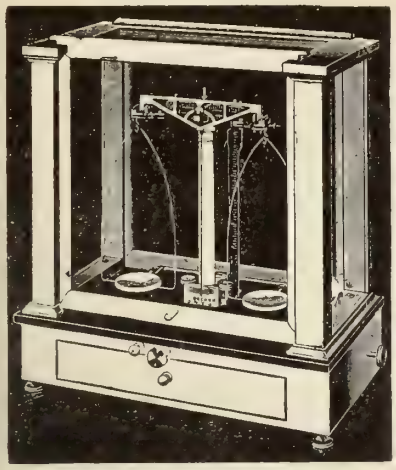

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(Continued on page 47)

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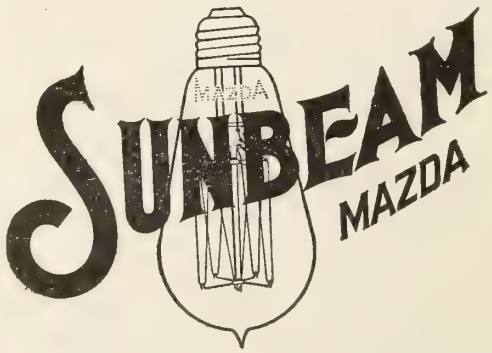

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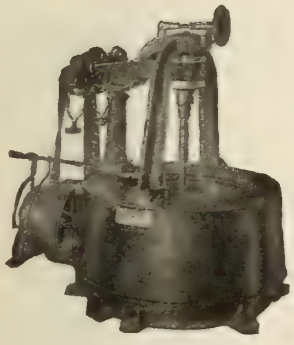

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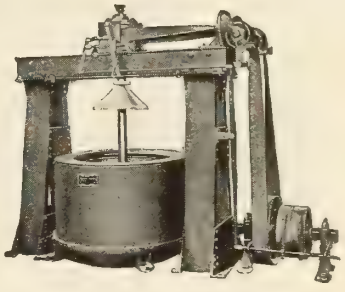

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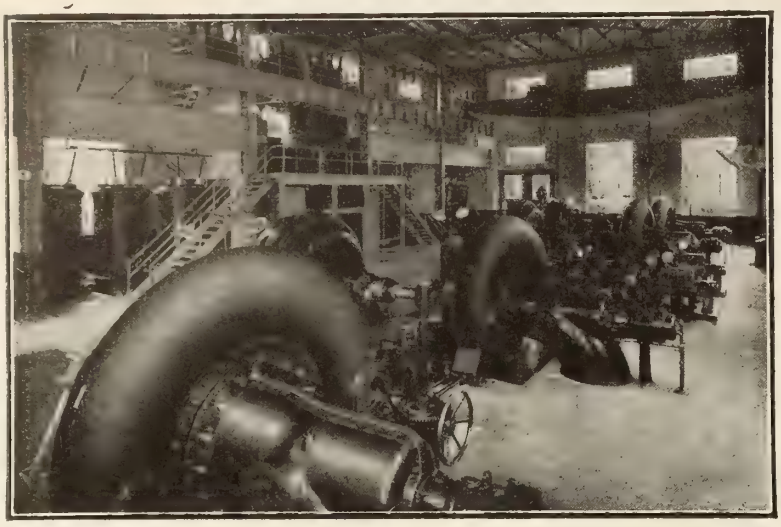

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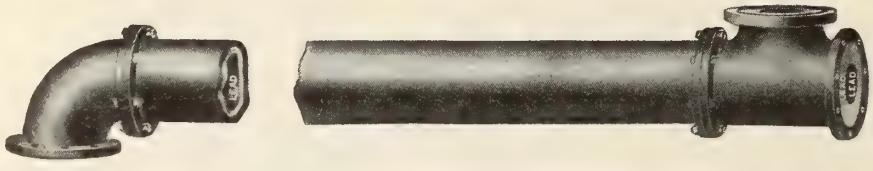

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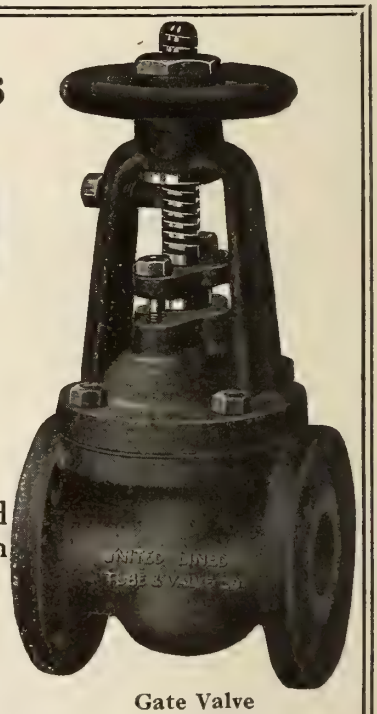

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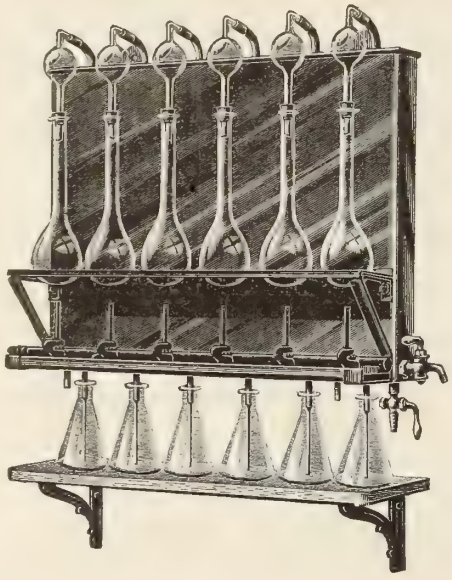

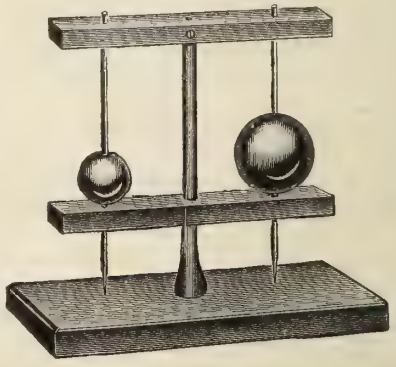

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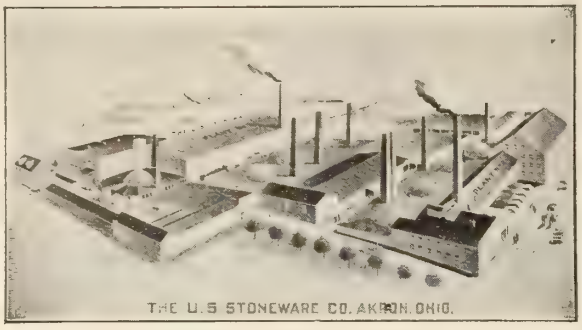

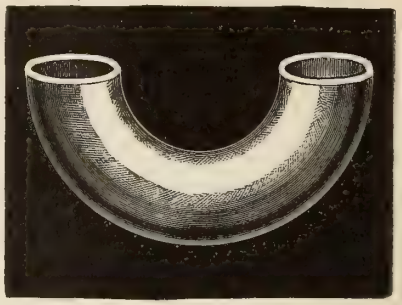

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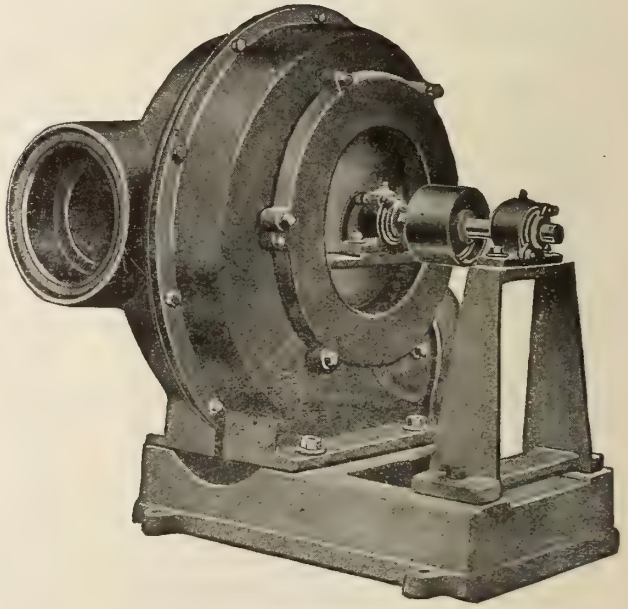

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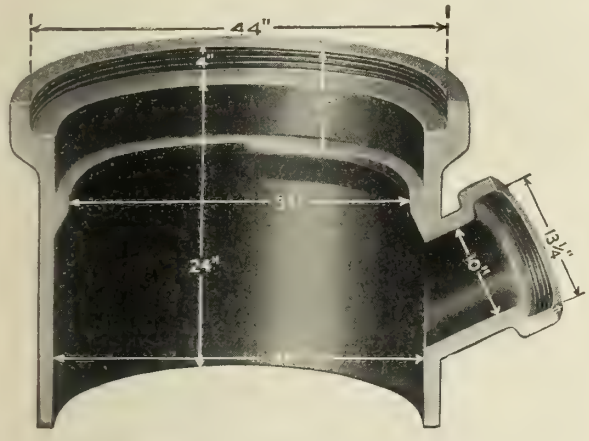

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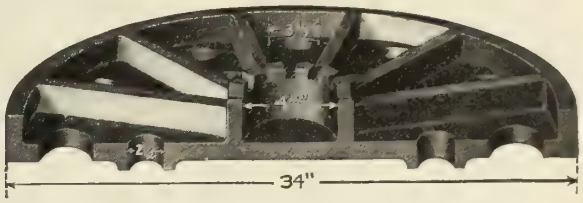

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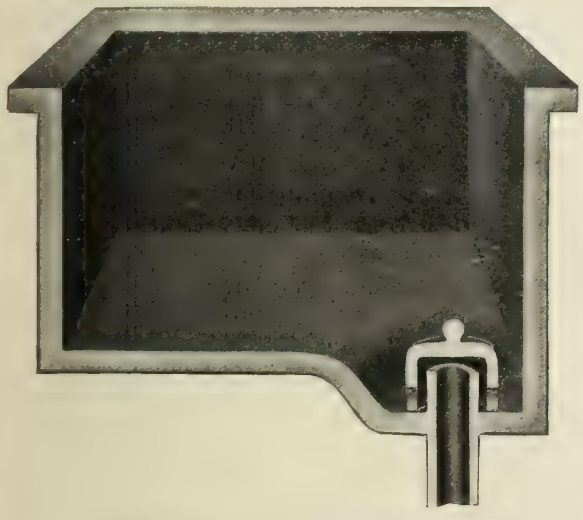

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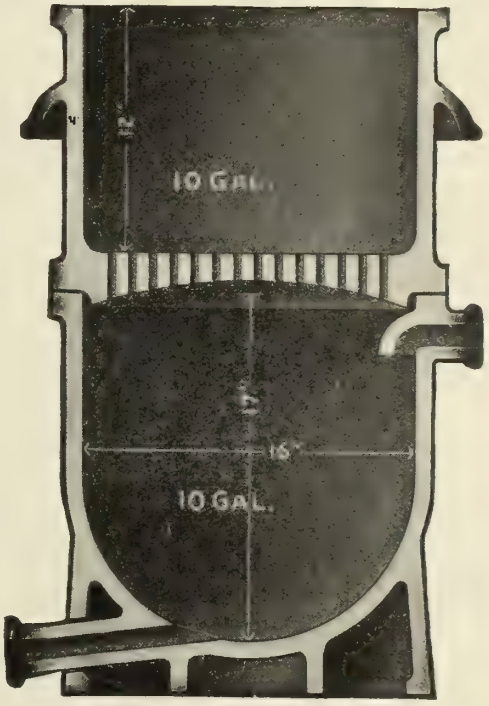

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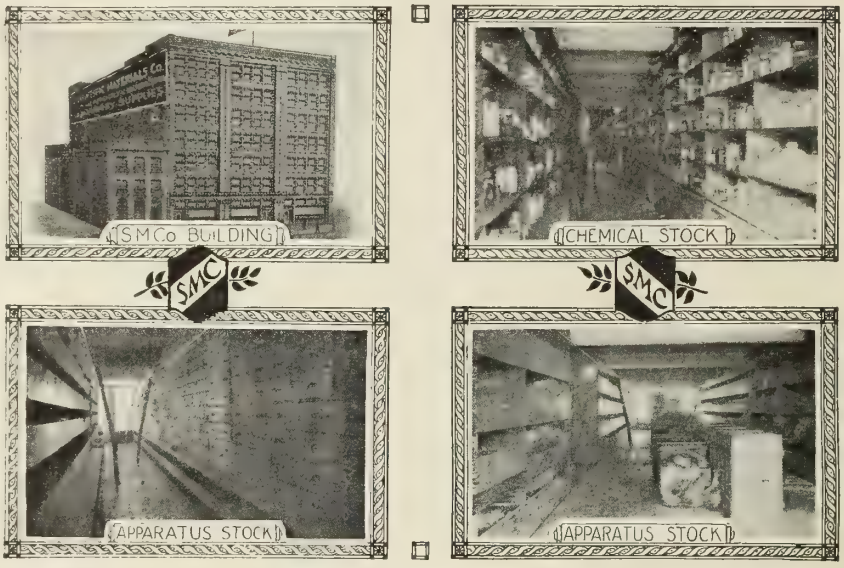

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WORK ordered by the Government and done directly for it was perhaps the most interesting. Our files for 1917 and 1918 contain countless orders from the Gas Defense, Gas Offense, the Army Medical Schools, the Aviation Fields, the Medical Supply Depots, etc., for apparatus and devices of many special kinds "as per instructions to the Machine Shop." This labor was not limited to experimental work, but quantity production was also effected, as evidenced by the fact that thousands of gas detectors used by the American Army on the fields of France bore our trademark.

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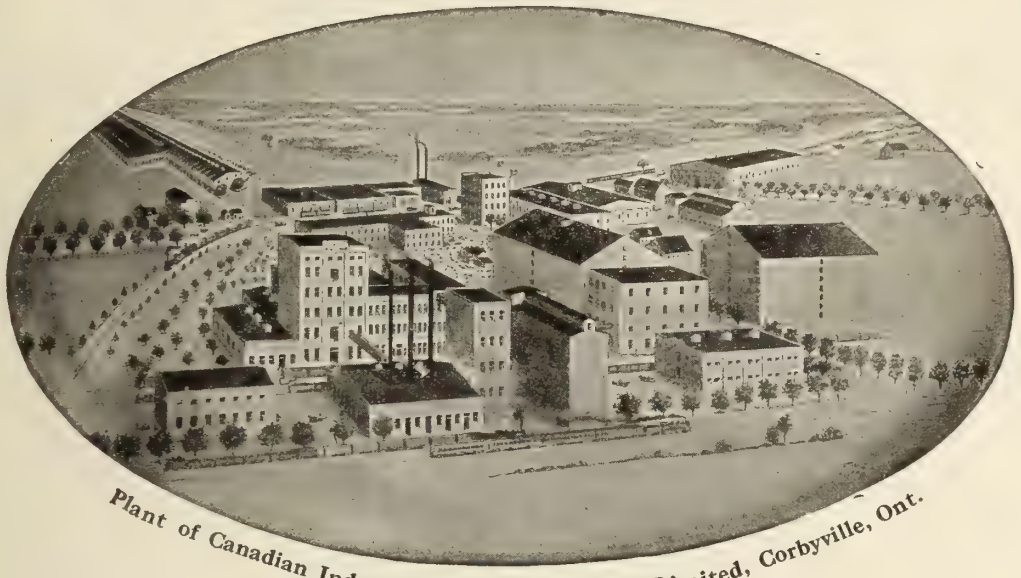

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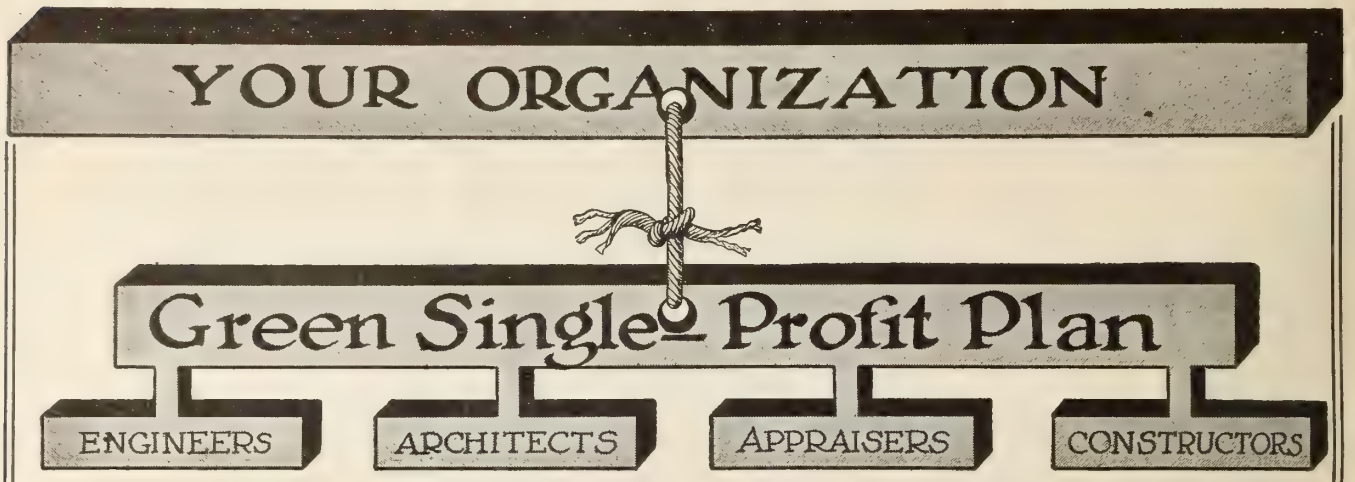

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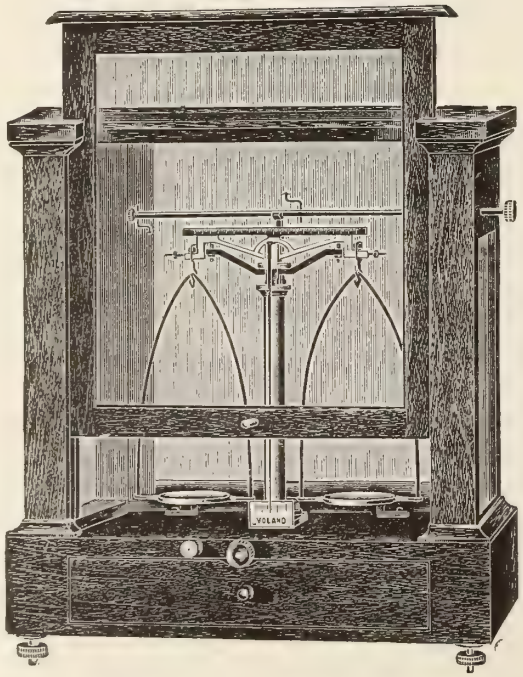

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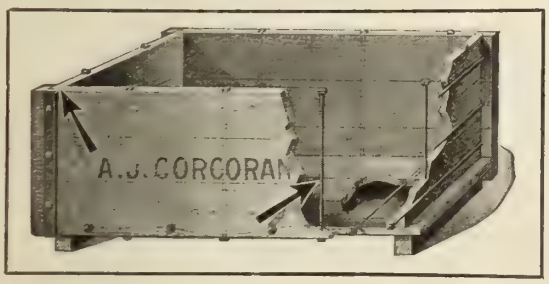

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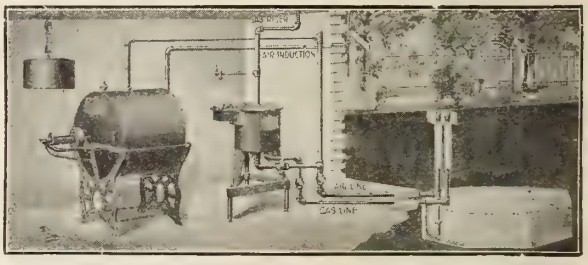

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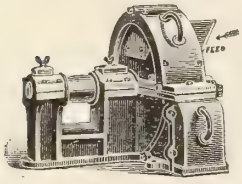

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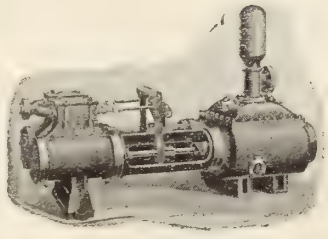

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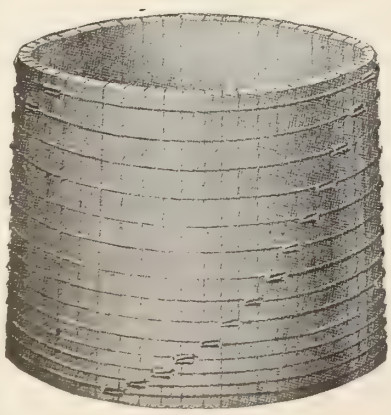

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TO OUR SUBSCRIBERS.

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Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

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THE CHEMICAL PATENT SITUATION.

AT the commencement of the war, an Order-in-Council was passed by the Canadian Government under authority of the War Measures Act, in which it was provided that all enemy-owned patents, registered in the Canadian Patent Office, would be made available to Canadian manufacturers under license from the Patent Office, such license to be valid for the life of the patent referred to, and at a nominal cost.

Unfortunately, Canadian manufacturers have not taken advantage of this offer to any appreciable extent, so that, to date, only a few patents have been applied for under this arrangement. These few have been quite profitable.

On the entrance of the United States into the war, representatives of the government of that country conferred with our government, with the result that similar action was taken at Washington to that adopted here.

The manufacturers of the United States, however, not content with the legislation enacted, made representations to their government such that on November 4th, 1918, the United States "Trading with the Enemy Act" was so amended that for the first time the Alien Property Custodian was enabled to take over all enemy-owned patents, as he had already taken over other alien property.

These patents, for the most part, had not been taken out with any intention of initiating manufacturing in the United States, but were solely for the purpose of preventing the manufacture in that country, or the importation from countries other than Germany of the articles covered by these patents.

This purpose had been well served prior to the war, and this idea led to the conception that if the importation of Swiss, French and English dyes had been successfully prevented by their use, then these patents, in the hands of the people of the United States, would presumably serve to prevent importations from Germany, after the war. These considerations were laid before various associations of chemical manufacturers, and the suggestion met with instantaneous and enthusiastic approval. As a result,

a corporation has been organized to be known as the "Chemical Foundation, Inc.," in which practically every important manufacturer in the United States will be a stockholder, and the purpose of which is "to acquire by purchase these German patents, and to hold them as trustee for American industry, for the Americanization of such institutions as may be affected thereby, for the exclusion or elimination of alien interests hostile or detrimental to the said industries, and for the advancement of chemical and allied science and industry in the United States."

In Canada, the license system still rules. With the signing of peace treaties, the Orders-in-Council passed under the War Measures Act will automatically be cancelled, or if their life is extended it will only be by a special Order-in-Council, and for a short period.

Unless some immediate action is taken by our Canadian manufacturers to secure to Canada the use of these patents through some organization similar to the Chemical Foundation in the United States, all the enemy-owned patents for the use of which licenses have not been granted, will revert to the patentees, and Canadians, eventually desirous of utilizing many chemical processes, will find that their ideas are covered by German-owned patents.

The Patent Office is sympathetic with the Canadian industrialist, and particularly so with the chemical manufacturer, but this office will not initiate the action here proposed until the Canadian manufacturers express a desire that such a course should be followed. There are hundreds of German chemical patents registered at Ottawa. Though many are probably worthless, there is no doubt that many are of considerable value.

At any rate, what information is of value should be conserved to Canadians, for the statement that these patents were only taken out in the United States to prevent manufacture there or importations from countries other than Germany, holds equally well in regard to German patents taken out in this country.

The appeal is to the chemical manufacturers of Canada; and whether we shall continue to import about thirty million dollars worth of drugs, dyes and chemicals, while our exports in the same lines are not greater than fifteen millions, or whether Canadian chemists are to be given a chance to develop Canadian chemical industries as they showed themselves capable of doing during the war, is the question that the manufacturers of Canada, particularly those whose interests lie along chemical lines, must decide one way or the other, either by action or indifference, in the very immediate future.

The Canadian chemist appeals. What shall the answer be?

RESOURCES OF NORTHERN MANITOBA.

HISTORY records varied developments for this central province. How it came about that for a long time the imagination of the East was not great enough to comprehend the possibilities of the West is something that we have no particular right to be proud of. Such publicity as Canada received in early days was most detrimental and we have much yet that does not do us a service in the minds of those who cannot weigh the evidence they receive. Even our closest neighbors are at loss to understand how the rocks, snow and Indians of their mental pictures of Canadian conditions can ever melt into industrial developments worthy of large cities and smiling farm lands.

It is the railroads, burdens as they may be, that bring in the daylight and there are many now struggling to adjust themselves to the possibilities that Northern Manitoba has possibilities of great value in its minerals, pulpwood, water powers and agricultural areas. Originally, the Hudson's Bay Company had all their posts on the shores of the great Bay. Later, with other developments, these lost their importance and now are again being reviewed.

The development of this area, although only along general lines has practically assured the mining world that the prospects are very well worth careful investigation. The mineral wealth will assist other lines of development, and it is from this direction that the quickest results will most likely come.

In spite of all drawbacks during the war, some really remarkable development has taken place. At Flin Flon Lake, twenty million tons of sulphide ore, containing on the average over one per cent. copper and yielding gold, copper and silver to the value of from $8 to $10 per ton under normal prices have been proven of by one company. A notable war effort was the bringing out of 3,335 tons of ore from Schist Lake, about 40 miles to the railroad, which, when shipped to Trail, gave 337 ounces of gold, 60 ounces of silver, and 1,113,935 pounds of copper. The average for the lot was 17 per cent. copper. This was all taken from an open cut by steam drills and horse derricks.

In a sentence, it is sufficient to say that gold prospects are most encouraging in several districts.

These developments of mineral resources, while in themselves startling, are significant of a changing conception regarding the ultimate future of the Western provinces of Canada. They appear to be entering upon the beginning of a fuller development than ever seemed probable in the past, and as each one brings its hidden treasures to the front, the outside world is stimulated by a new interest and capital, with population, gradually moving northward.

THE RESEARCH SPIRIT.

THERE are continual indications appearing that new life springs have been touched in connection with the very broad problem of advancing the best interests of mankind through applications of the principles of scientific research. The March issue of the University of Toronto Monthly has been properly called a scientific research number. To many graduates of universities and the public generally its contents will be considered very interesting, while to an increasing number its message and the significance of its contents is vital. The business of placing these ideas where they will be widely read is exceedingly important. All branches and departments of science at our universities have good work to their credit. Professors are continually training and selecting men for important industrial positions and there is a tendency for the capital that has been thus created to forget the period in its career when it was a starving industrial weakling. The greatest efforts are being made in American universities to bring back to the universities those teachers who were for the moment thrown out of their regular work into the whirlwind of industry and war. It is feared that, having tasted of the forbidden fruit, teaching will have lost its appeal. Teachers of science are ever presented with business and industrial opportunities not given to those engaged in teaching history or languages. The war has forced a limited amount of recognition on the part of other professions and the general public for really trained scientists, and we believe that had events remained normal, no one would ever have considered devoting a special issue of a university publication to a survey of scientific achievement.

One of the outstanding advances made during the last two years at the University of Toronto has been the establishing of a school of engineering research. Men of strong personality and high research ability have been behind this movement. Difficulties have been faced and many more are ahead, but the structure is erected and already results are showing. The aim is simple and direct. It is planned that for the next generation the University of Toronto shall become as well known for its research spirit and accomplishment as it has been so long for its undergraduate courses and training.

The account of work accomplished, as given in this research number, is full and complete. A spirit of advance is shown in every department and it is very fitting that this timely summary should appear now when we are, as it were, taking stock of our war effort before advancing sharply on our peace problems.

No matter how slow the reconstruction period may be or how deadly business stagnation might become, there will remain in the science departments of all our Canadian universities men who have the faith and ability necessary to bring to pass those days when Canadian resources shall be developed fully for the national welfare of a great multitude.

THE ORGANIZATION PROBLEM.

FROM the interest shown by chemists from all parts of the Dominion, it is very evident that much is expected from the Annual Convention to be held this year in Montreal on May 16th and 17th. The problems before our chemists are complicated at best and in none of the large centres is there to be found a single-minded group of men.

It will be necessary to sound opinion right to its pocket before it is made clear how far chemists may hope to proceed. Everyone is united in the idea that some type of technical association would be a good thing from the viewpoint, not only of chemists themselves but also from the standpoint of the Government and the public. Consideration must be given for the natural desire for a Canadian organization which will be distinct among the similar societies of other countries. The present situation must be combined to a certain extent with probable future developments. Organizations already established may put forth their claims for amalgamation with them, and these must be studied carefully by chemists. While everyone recognizes the necessity for doing something, it will be the problem of the Convention to evolve some basis for united action which will be broad enough to embrace all properly qualified chemists and will at the same time be feasible and sound from the practical viewpoint.

The younger men are the important ones who, in a sense, must choose now a policy that they are all ready to support and finance. If they have the will to do it, anything may be accomplished; if they fail in their hearty support, no movement will amount to more than a flash in the pan.

The Convention will have something for the manufacturer and business man, as well as chemists of all classes. We need immediate action in connection with some of the industries that are being held up in Canada because of delayed action or lack of action on the part of the Government. Much may be done to assist these situations if movements are initiated by a representative body of men. It should be strongly urged that chemists and manufacturers interested in our Canadian chemical and alllied industries make a special point of being in Montreal at this time.

SIGNIFICANT GOVERNMENT ACTION.

THE consciousness of the Canadian public mind is being vividly awakened to the imperative necessity of the Federal Government undertaking a constructive policy to secure the development of our mineral resources, particularly those of oil, iron and coal.

The beginnings of a movement really worth while were made when a committee of Western members at Ottawa found time to actually formulate a development policy with the following definite objects in view:

(a) Creating wealth to pay our national debt.

(b) Providing raw materials for the establishment of basic national industries.

(c) Solving the tariff tangle by (1) developing the mineral resources of Western Canada and thus supplying materials for the creation of industrial communities and thereby making common the interests of all Canadian people, and, (2) developing basic national industries which every Canadian will protect if necessary.

(d) Producing our own raw materials for the educational and economic benefit of our Canadian people.

The keen business insight shown in reference to national development by these men, who represent agricultural interests, is something that Eastern members who are backed up by fairly well-established manufacturing centres should recognize at once.

We are the simplest minded people in the world, and are worthy to be classed with the Chinese in the way in which we have allowed our natural heritage to be juggled in the hands of governments and capital over which we had no control. We owe little to the past, and the future generations will never praise us if we do not do our share in inaugurating a scientific national policy which will not only place Canada in an independent position economically, but which should reasonably result in making Canada the seat of a British Empire.

SCHOOL OF ENGINEERING RESEARCH.

IN 1917 a school of engineering research was established within the Faculty of Applied Science at the University of Toronto. Supervision was placed in the hands of a committee of management composed of fifteen members of the Faculty Council. Dr. M. C. Boswell has acted as secretary for the new organization. All the various branches of engineering have joined forces in this effort. The primary aim is the training of men in research methods, thus meeting, in a gradually increasing degree, the demand for research men in the industries and in the government research laboratories about to be established in Canada. A secondary aim is the performance of useful research within the School itself.

In choosing problems, the committeee of management has two aims in view, viz., the specific problem relating to a specific industry or raw material and having a specific end in view, and the general problem which seeks for some underlying principle or generalization.

One of the most remarkable achievements in connection with this effort has been the modest cost of the work carried on. With an expenditure of $4,000 during 1917-18 some thirteen investigations have been carried out. Only a beginning has been made and the effort is one which will naturally be supported. Research assistants are needed along with funds for the support and the load of teaching duties must be removed from those members of the staff under whose direction the researches are being conducted.

GERMAN PATENTS.

IF the manufacturers of Canada desire to use the German patents which have been available through the war period, immediate action is necessary. Our methods of handling German property in Canada have been rather loose in many instances. The Kaiser himself was able to pull out with his personal property after war was declared by a simple method of transfer. Now the Government is waiting action on the part of our manufacturers. If this is not taken, nothing can be done. The German dye and chemical patents registered here now could be taken over if there was any organized push made to do it.

Legal opinion to the contrary, it seems that something should be done. Why Canadian manufacturers should hesitate in a matter of this kind because they fear anything that Germany might do later on, we do not know. Lack of action can only be explained by lack of conception of the opportunity that is slipping away. What would a real live Minister of Industrial Development do in a matter of this kind?

CONVERTING ARTS TO SCIENCES.

ORDINARILY we are prone to consider some of our well-known industries as sciences. It is essential, however, for the capital invested to realize that this is far from being the case. Before any desire to establish a research department can be created it is essential to enlighten owners and those interested in a business way in any particular industry. When it is realized that a stationary or narrow type of perfection has been attained and that by digging deeper into fundamentals it might be possible to advance beyond this stage in the end; then, and then only, is there much hope that a really scientific man, from the academic viewpoint, will be given a chance to create a research department.

Any industry that can be named involves the labors of artists. These men know how to do things with great rapidity and with sure success. Somebody must have thought about the process or operation in the past, but the present operator is merely a machine. The growth may have been generations slow and all sorts of laughable side-whiskers may have been handed down, but the results on the whole are good and we have an artist at his work. Such a worker does not mix in all proportions with what the modern post-graduate school tends to send to the same industry. Friction arises from the mutual disrespect that may be generated. At the same time, our industries need these latter men because without them, advances come by chance and with them they may come not only by this means, but by the slow, sure process of elimination. There are wonderful fields awaiting the right touch in every industry. Every chief chemist feels how little he knows and can point out possibilities enough for an army of research workers. These things, however, should be introduced at directors' meetings and every place where men of influence meet together in order that oil may be poured down on the needy bearings that are literally howling for the touch and attention of the really trained scientific industrialist.

THE PUBLICATION OF SCIENTIFIC LITERATURE IN CANADA.

WE have a number of channels for the publication of scientific reports. The Dominion Government leads the way and much valuable original work may be found in the publications issued from various departments. Canada has become known abroad and capital has been instructed through these efforts.

Engineering and mining associations have added their literature and we have numerous trade and technical journals describing advances as they occur, but carrying very few original papers resulting from purely scientific research work.

Our universities and to a lesser degree our industries have published many papers during previous years, especially in American and English journals. In this way, Canadians may create names for themselves as individuals in foreign countries, but the net result is that people abroad do not know in any concrete way what advances in theory or practice have been made by Canadian research workers. In the mind of the average American or English scientific man we have produced practically nothing. Of course, in a measure, and speaking relatively, he may be correct, but at the same time if our results are so small from publishing abroad, might it not be well to restrict the export of such original scientific literature until it has been published here? A committee has been appointed by the Advisory Research Council to consider suitable means for publishing such work in Canada and the time has come when Canadian effort should be individualized.

It is another case of advertising this country by every possible means. It should never be advocated that we really need more scientific journals than we have. We do not need them, but until such time as we have completely demolished the names of nations as connected with scientific publications, Canada cannot afford to give away her scientific papers either to England or the United States to swell the volume of literature now produced in these countries. Even from the point of view of the individual it is a question if much prestige abroad would be lost by publishing the results of Canadian research work in Canada. We should create a fashion for publishing scientific papers at home.

PROGRAM OF CHEMICAL CONVENTION.

Montreal, May 16th, 17th, 1919.

Arrangements have been made with the Windsor Hotel. Meetings and dinners will be held there. Reservations should be made in advance.

Friday, May 16th—Morning.

9.30 a.m., Registration and introductions.

10 a.m. Papers—A series of papers outlining the war efforts of some Canadian Chemical Industries will be presented.

Afternoon—Choice of Visits to Various Plants.

(1) St. Lawrence Sugar Refinery.
(2) Canadian Consolidated Rubber Co.
(3) Dominion Glass Co.
(4) Vickers, Limited.
(5) Filtration Plant.
(6) Gas Plant, La Salle.

Alternative for the ladies, motoring and moving pictures.

7.00 p.m. Dinner and Theatre Party.

Saturday, May 17th—Morning.

9.30 a.m. Business meeting discussing Canadian Chemists' Organization, Bureau of Employment, Paid Secretary, followed by elections.

Afternoon—Papers: Technical and Descriptive.

4 p.m. Lachine for Rapids Trip.

7.00 p.m. Annual dinner and dance.

Be your own representative to this Convention and Annual Meeting of the Society of Chemical Industry.

CORRESPONDENCE

THE ORGANIZATION OF CANADIAN CHEMISTS.

Toronto, Apirl 28th, 1919.

The Editor, Canadian Chemical Journal:

Dear Sir,—Adverting to your editorial and to Professor Parker's letter in the April number of the Journal, while heartily in favor of the formation of an effective Association of Chemists in Canada, I do not wholly concur in the recommendations of the Chemists' Organization Committee formed at the 1918 Convention (which military duty pre-

vented me attending), and desire to submit the following remarks:—

2. The formation of a new association, comprising the officers proposed in paragraph 6 of the circular, with powers as a registering and examining body, would necessitate the expenditure of large sums on salaries, rent and examination expenses, roughly estimated as follows:—

Rent, etc., of Headquarters, Registration and Employment Bureaus	$1,000
Furnishings and upkeep	200
Salaries and wages	6,000
Printing and postage	1,000
Examiners' fees	1,000
Fees to institutions whose laboratories are used for examinations	500
	$9,700

To this must be added the travelling expenses of officers, which would be considerable.

To meet this expense, the subscriptions of approximately one thousand Fellows would be required annually, and it would, therefore, be necessary to be assured that there were a thousand chemists in the Dominion, with the qualifications required by the British Institute, who would be willing to accept the financial responsibilities which membership would entail on them individually and collectively. This I am disposed to doubt.

3. I am not in favor of the proposed name "The Institute of Chemistry of Canada," nor of the creation of Fellows and Associates entitled to letters so closely resembling those of the Institute of Chemistry, and would recommend that the title of an association, if formed, might be "The Canadian Chemical Institute," or "The Association of Canadian Chemists," duly authorized by Royal Charter, with Fellowship and Associateship therein, if found desirable or feasible.

4. For many years past, I have endeavored to interest Canadian chemists in the Institute of Chemistry (upon whose regulations the proposals contained in the statement under review are evidently based), admission to which is sought by all chemists resident in Great Britain and Ireland, Australia, New Zealand, South Africa, India and the Crown Colonies. The formation of a local institute would not tend to connect us any closer with these, but would have the opposite effect, besides leading to the multiplication of societies. On the other hand, co-operation with the existing Institute would complete the "family circle," and result in an "All-British" qualification being granted to those fulfilling its strict requirements.

In this connection, it may be pointed out that efforts are being made to secure an "All-British" qualification in medicine; the present proposals are, therefore, a retrogression from the principles of one standard of qualification throughout the Empire.

5. This unification of professional standard and the objects of the proposed association would, in my opinion, be met much more satisfactorily and at no expense to any one but the candidates and the Institute were the Fellows and Associates resident in Canada to proceed as follows:—

(a) Approach the Council in London with a request that to its name be added the words "and of the Overseas Dominions." The name at present is "The Institute of Chemistry of Great Britain and Ireland."

(b) Secure the election to the Institute without examination of chemists qualified by the regulations.

(c) With this increased local representation in Canada, obtain authority to form a Canadian branch or section of the Institute, with local corresponding secretaries and committees at the large centres, where examinations of approved candidates would be carried out under instructions from the Council.

(d) These local committees could then take steps to secure the attainment of the objects of the Association specified in paragraph 8 of the circular.

6. Let me add that the views expressed above are concurred in by the few chemists with whom I have had an opportunity of discussing the question, among them Professor W. H. Ellis, Toronto, who (I understand) intends communicating to your columns suggestions for an even wider scheme for securing the recognition of the professions involving long scientific training.

Yours truly,

COL. W. R. LANG,
University of Toronto.

FROM THE SECRETARY, C. O. C.

Montreal, April 25th, 1919.

To the Editor, The Canadian Chemical Journal:

Dear Sir,—Thinking that it will be of interest to your readers to know what has happened during the last month in regard to matters concerning the Chemists' Organization Movement, I send you the following notes:—

Letters have been received by the Secretary from Buckingham, P.Q.; Nanaimo, B.C.; Lindsay, Ont.; Longueuil, P.Q.; London, Ont.; Ottawa, Copper Cliff, Ont.; St. Thomas, Ont.; Beloeil, P.Q.; Winnipeg, Calgary, Kitchener, Toronto, Haileybury, Ont., and Shawinigan Falls, P.Q.

Sixteen letters have been received in all, only one of which is not in favor of the proposed scheme; the others, and they cover a wide range of territory, being entirely favorable to the scheme as a whole.

Further, the following subscriptions have been received, up to April 25th:—

R. M. Coleman	$5.00	A. J. MacDougall	$5.00
A. H. Maude	5.00	C. W. Hancock	2.00
D. John	10.00	A. W. Alcock	2.50
		F. Barnes	1.25

It is evident from the above that the movement is meeting a real need. It should, therefore, receive the attention of every chemist, either in the way of approval or criticism. The undersigned trusts that many more letters will be received prior to the Convention.

Yours truly,

HAROLD J. ROAST,
Secretary-Treasurer, C.O.C.

RESEARCH AT QUEEN'S UNIVERSITY.

The announcement has been made that Mr. M. J. O'Brien, contractor, will spend from $15,000 to $20,000 for research work to be carried on at Queen's University, Kingston, Ont., during the next five years. Growing demands upon the University for industrial research have necessitated a larger research laboratory, for the installation of which part of Mr. O'Brien's gift will be expended.

In addition to the above, Mr. G. Y. Chown has established a Research Chair. $50,000 is thus being devoted for pure research in either Physics or Chemistry. The position is now open and offers an excellent opportunity for a man to devote his whole time to research work.

THE WHITE PIGMENTS.*

A Summary of the developments of white paint pigments, with a survey of present practice and the magnitude of these industries.

By S. J. COOK, B.A., A.I.C. Public Analyst, Ottawa.

THE paint industry is doing a large part in stemming the tide of economic waste, and in the United States and Canada, the Paint Manufacturers' Associations have undertaken to educate the public about paint; its nature, uses, and value as a protective agent. This campaign has been a success financially for it has resulted in the increased and probably more intelligent use of mixed paints. In this country the campaign advocating the greater use of paint has really only been brought to the public in very recent years, but it is significant to note that in spite of the war, the use of paint increased business done by outstanding makers in Canada and at least one of the largest paint firms in this country announced that the past year had been one of the best in its history.

White Lead.

Of the white pigments the oldest and best known and still the most extensively used and preferred is our time-honored friend, white lead. White lead and lithopone are both precipitation products; the zinc oxides, leaded zinc, zinc lead and basic sulphate white lead or sublimed white lead as it is often called, are fume process pigments.

Theophrastus, (373-287 B.C.) is quoted by Klein in his "History of Stones," as follows:—

"Lead is placed in earthen vessels over sharp vinegar, and after it has acquired some thickness or a sort of rust, which it commonly does in about ten days, they open the vessels and scrape it off, as it were in a sort of foulness; they then place the lead over vinegar again, repeating over and over again the same method of scraping it till it has wholly dissolved. What has been scraped off they then beat to a powder, and boil for a long time, and what at last subsides to the bottom of the vessel is "Ceruse."

This old method undoubtedly produced the basic carbonate of lead, and as noted before, the clay pot method is still in use, though in a somewhat developed form.

White lead is made by one of two processes in general. Either the old clay pot method or Dutch Process, or the newer and commonly called "Quick Process" is used. Those of you who are familiar with the Dutch Process will recall that a buckle of thin sheet lead about four inches wide is rolled up and placed in a clay pot of about a quart (or less) capacity. This pot contains some acetic acid. In the bottom of the stack moist tanbark is spread. The pots are then placed on shelves over this bark and more pots are placed on the boards which rest on the underlying pots until the building of the stack is complete. The acid corrodes the lead and the carbon dioxide gas from the fermenting tan bark decomposes the corrosion on the lead buckle. After about three months the metallic lead has been entirely corroded and the stack is taken down, the white lead broken up, washed, and prepared for the market. Very often it is ground with oil while still wet and the water thus displaced by oil. Some water remains in this instance, but there is the advantage, according to some authorities at least, that a small percentage of water (under 3%) adds to the working qualities of this pigment in prepared paints. In 1914, the estimated world's production of white lead, according to Klein (Paint and Varnish Soc., London, 1913) was 275,000 tons annually, distributed as follows:—

United States	120,000	English tons dry
England	55,000	
Germany	36,500	
France	22,000	
Belgium	15,000	
Russia	14,500	
Italy	4,500	
Holland	2,500	
Spain	2,500	
Canada	2,500	

The approximate amount made by the stack or Dutch Process was 180,000 tons, or about two-thirds. Just how true these figures are for the world to-day, is not known. Last summer a representative of one of the larger makers of white lead in Canada assured me that he thought the stack process had been practically discarded in Canada, partly because of the slowness of the process, but mostly because the white lead makers were satisfied that the product as made to-day by the quick process was quite as good, and it involved no long tying up of capital as does the other process.

Of the quick processes, there are many, but the principle of most of them is the same. The attempt is made to produce artificially and in greater concentration the conditions which prevail in the stack. In the Carter process as used in the United States, metallic lead is granulated, placed in large revolving drums, and sprayed with acetic acid and water. Carbon dioxide is passed into the drum and the agitation is continued for a period of from six days to two weeks. The white lead produced is thoroughly levigated and then dried. In one Canadian factory the process only differs in that acetic acid is sprayed over a tank full of granulated lead and the lead acetate formed returned until it reaches a certain density. Carbon dioxide is then blown through the liquid and the white lead thereby produced.

The composition of basic carbonate white lead is generally given as $2PbCO_3.Pb(OH)_2$. When mixed with oil the hydrate unites with the oil to form a lead soap. Quick process white leads ordinarily require more oil to make paste lead than the Dutch process. For the latter, about five pounds of oil will work up with 100 lbs. lead.

Sublimed or Basic Sulphate White Lead.

Basic sulphate white lead is one of the newer pigments. Its history dates back only to 1872 and to the work of Lewis and Bartlett at that time. It was while Mr. Bartlett was working around a zinc smelter near Bethlehem, Pa., that he picked up a beautifully crystallized piece of galena. Passing a calcining furnace, he threw the specimen into the fire; immediately it ignited and passed off as a white fume. He conceived the idea that the product might be white lead and immediately began experiments to find out more about this substance. Great advances have since been made in the manufacture of this interesting pigment which was first commercially produced by the Picher Lead Co. It is extremely stable, very fine and amorphous, has good hiding power and durability and has come into great prominence as a constituent of paints in recent years. In composition it conforms quite closely to:—

Lead Sulphate	75%
Lead Oxide	20%
Zinc Oxide	5%

From time to time discussion has arisen regarding the propriety of calling this latter mentioned product white lead, and the Paint Manufacturers' Association of the United States took up the question with the result that in 1916 it was decided that all forms of the carbonate or Dutch process lead should be called Basic Carbonate White Lead, and all the sublimed lead products should be known as Basic Sulphate White Lead. This eliminates confusion in terminology and is a ruling that might well be adopted in Canada.

Zinc Oxide.

The great competitor of white lead is zinc oxide. As long as white lead was the only white pigment known and used, its defects were not observed. As soon, however, as new white pigments were made it was natural in the competition created that the defects in the older pigment should be pointed out. For instance, zinc oxide mixed with oil dries to a hard film, Basic carbonate white lead dries to a much softer and more chalk-like surface. Just as zinc added to certain metals gives hardness to the resulting alloy, 80 by analogy, zinc oxide added to white lead produces a pigment which when mixed with oil and applied gives a harder and more durable surface than the white lead alone. Zinc oxide, as a paint pigment has been made commercially since about 1850. The New Jersey Zinc Co., working on Franklinite ore, developed a direct process which is now used for making the greater part of the zinc oxide on the American market. Franklinite ore which is a zinc-iron-manganese spinel is the only ore used in the production of lead-free zinc oxide. The ore is mined, washed, crushed, and passed by a belt conveyor over a separating table where the Franklinite is removed by an electric magnet. The separated ore contains about 60% iron, the balance being manganese and zinc. The ore is then mixed with coal and spread on grates through which air is blown, and the zinc in the ore thereby reduced. The oxidizing atmosphere converts the volatilized zinc into the oxide. It is then drawn by the aid of fans, through large cooling pipes into fabric bags and those are tapped at the bottom from time to time. The two plants of the New Jersey Zinc Co., at Palmerston, Pa., are the largest in the world. They contain 60 independent blocks of furnaces and the bag room is 805 feet long, 64 feet wide and 59 feet high. The bags in this room sewn end to end would extend a distance of about thirty miles. It only remains to say that the use of zinc oxide as a pigment is universal and the supply is far below the demand.

Leaded Zincs and Zinc Lead.

The ore used in the manufacture of these pigments, which are also made by the fume process, are zinc-lead ores. The first used were those about Leadville, Colorado, and resulted in a pigment containing about equal parts lead sulphate and zinc oxide. During recent years the process has been considerably improved and now Ozark White, a 60-40 zinc-oxide-lead-sulphate pigment is the one used. The term **leaded zinc** is now used to describe American process zinc oxides made by directly subliming and oxidizing a zinc ore containing varying proportions of lead. These ores are plentiful while the ores suitable for making lead-free zinc ore, not so widely distributed. These leaded zincs were the only ones available for use in the manufacture of paints, in the United States during the war as the other ore was required for the production of spelter. Four grades are recognized in the trade and are as follows:

Standard	containing	about	5%	basic	Lead	Sulphate.
Sterling	"	"	10%	"	"	"
Superior	"	"	20%	"	"	"
Lehigh	"	"	35%	"	"	"

Zinc lead white is said to possess all the virtues of both zinc oxide and basic sulphate white lead. In the Report on the Arlington Test Fence, American Society for testing materials this comment occurs:

> "Panel No. 107—Zinc lead white, shows no checking and the surface is very clean. None of the paints composed of a single primary pigment are equal to paints made up of composite-pigments, except zinc lead white, which is, of course, actually a composite-pigment."

Lithopone.

Lithopone was apparently first produced by Orr in 1874, and at once developed in England and on the continent. In America production is increasing and this pigment is finding many new uses, notably in the manufacture of oil-cloth and linoleum as well as in the making of many paints. It is a very white pigment and has great hiding power. It is produced by bringing together equivalent proportions of zinc sulphate and barium sulphide, when an interchange takes place forming barium sulphate and zinc sulphide, both of which are precipitated together. The composition is approximately Barium sulphate 70%; Zinc Sulphide 30%. The precipitated pigment is calcined, quenched, washed and dried. The quenching after the calcining seems to be an essential feature of the process if the resulting pigment is to be a good paint pigment. Further oxidation of the zinc sulphide is thereby prevented. The formation of zinc oxide in appreciable quantities is a defect characteristic of the earlier makers. Heating not only dehydrates the zinc sulphide but produces a change in its physical condition so that it forms a dense mass with a good body which can be ground more readily. Gardner in his Paint Researches states that a mixture of ground barium sulphate and zinc sulphide is deficient in hiding power, while lithopone is conceded to be quite as good in hiding power as white lead. He explains this phenomenon, by saying that in the mixture there are transparent particles; while the lithopone consists of transparent particles which have absorbed the opaque substance, and consequently lithopone has considerably the greater hiding power. This explanation is offered. As a pigment lithopone is in use to-day, it is said, by every large manufacturer of paint in America.

The Inert Fillers and Extenders.

The use of the inert fillers or extenders which have been mentioned, as constituents of mixed paints is probably the most debated practice in the whole run of the paint maker's work. Originally, and the time is not far back—indeed, is still with us to some extent—the use of such materials as barytes or blanc fixe or Silica in paint of any sort was regarded as prima facie evidence of the intent on the part of the manufacturer to defraud an all too gullible public, and was consequently roundly denounced. But in recent years we have come to regard some things about paint in a different light than previously. It is still true, that when a maker offers paste white lead for sale, the article ought to be basic carbonate white lead ground in linseed oil, and no other pigment or filler should be present. The change I refer to, however, is that now a paint is not judged on the evidence of its chemical analysis alone;

the question of the purpose to which the paint is to be put is also considered. But first, let me describe these fillers very briefly; afterwards we may discuss their uses together with pigments described above.

Barium Sulphate.—Comes on the market either as the mineral barytes, ground finely, and usually water-floated; or as blanc fixe, the precipitated form commonly called artificial barium sulphate. In neither form is it in use as a pigment alone, but it is undoubtedly used in large quantities in admixture with white lead and zinc. It is said to give greater body to a lead paint, and to make far greater permanence in the finished work than is obtainable by the use of white lead alone. It probably finds its most useful application, however, as a base on which various coal tar colors can be precipitated. This illustrates exactly the point to which I made reference above. Hundreds of brands of Para-red paints are made which consist of 90% Barium Sulphate, probably, blanc fixe, an which 10% para-red has been precipitated. The blanc fixe in this instance is in no sense an adulterant any more than it is in the lithopone of which barium sulphates constitutes 70%. The large railroads and agricultural implement manufacturers maintain laboratories in which specifications are worked out from actual tests made and the painting of large implements by dipping and subsequent draining, calls for a paint rightly made. The painting of box cars by spraying is another instance in paint. It is to those firms who have made researches and have succeeded that we owe change in mental attitude regarding the proper formulas for paint. Nowadays one must know the use to which paint is to be put as well as the composition, in order intelligently to judge the article. These general remarks apply to all the inert fillers. A small percentage of an inert filler is often used to prevent a white lead paint from settling out to a hard cake in the can. Zinc oxide is practicaly the only pigment used singly in commerce. The white enamel paints are almost invariably zinc oxide, oil, varnish and drier. Another use which is ascribed to them is that of giving the property of "tooth" to the painted surface so that when repainting becomes necessary the surface will take hold of the new coat of paint satisfactorilly. Silica and asbestine are more used for this purpose, however.

Barium Carbonate—is practically new as a paint pigment. Only the artificial product is used. Ordinarily it is used mixed with zinc oxide to form the basis of a very good flat wall paint.

Silica, Infusorial Earth or Silex.—Silica is inert as a filler or extender but is used to give "tooth" to the plant. It is made by heating quartz rock to redness, quenching in water, grinding under water by aid of dragstones; it is then washed, floated, dried, and bottled and comes into commerce as an inpalpable fine white powder.

Gypsum or Hydrated Calcium Sulphate—is often used as a lake base, and this is true to a somewhat less extent of whiting or calcium carbonate. The white mineral primer, Paris white, gilder's white, are other names for chemically similar products. There are sometimes differences in the physical characteristics of these fillers.

Kaolin is the China clay of commerce and asbestine is a short fibre asbestos or magnesium silicate.

I do not wish to be interpreted as advocating the extensive use of fillers in paints. I want merely to point out that they have their place, and that when they are used with intelligence, desirable results are often obtained.

Toch, in his "Chemistry and Technology of Paints," states that the battleship-gray paint formerly used in the United States Navy, consisting of 45 per cent. zinc, 45 per cent. basic carbonate lead and 10 per cent. black, gave very poor results, while one devised by Toch, and consisting of 45 per cent. zinc oxide, 45 per cent. blanc fixe, and 10 per cent. graphite and lampblack, is a less costly paint, which wears much better.

This serves well to illustrate the remark previously made—that paints must be judged with due regard to the use to which it is intended they shall be put.

Without further discussion of the inert fillers, I want to mention some of the characteristics of the various pigments here described and to conclude my address with a brief outline of the nature of the white pigments offered on the Canadian market to-day under the name of mixed white paint.

In point of ease of application, white lead is undoubtedly the painter's favorite. It also has greater hiding power than the other white pigments, except perhaps lithopone. When used alone with linseed oil, however, white lead dries to a rather soft surface, which weathers to a chalky coat, and is easily abraded. This weakness of white lead is the strength of white zinc or zinc oxide, which latter pigment, mixed with oil, dries more slowly and yields a hard, almost vitreous, surface. For this reason, combinations of basic carbon to white lead and zinc oxide are very desirable and are much used. This lead-zinc statement is a repetition of a remark made previously, but the importance of these pigments justifies the repetition. A favorite combination is 60 per cent. basic carbonate white lead and 40 per cent. zinc oxide.

The discussion of mixed paints is beyond the scope of this paper, but from my own observations during the past few years in which I have given considerable time to the examination and analysis of various kinds of paint and particularly white paint. I may tell you that the composition of even the white paints alone varies exceedingly, nor is the argument of the varying uses to which the ordinary mixed white paints are put sufficiently good to justify this great variation in composition. The materials used are the pigments and fillers which I have described. The unfortunate feature of the situation is that neither the consumer nor the honest manufacturer have any protection against the unscrupulous marker.

Suggested Government Control.

A labelling law, which would compel the printing of a truthful statement of the composition of not only the pigment, but the liquid portion as well, would be beneficial. It would then be possible to carry on educational campaigns to teach people the proper uses of the various pigments in painting. At present, some of our white paints contain as high as 70 per cent. basic carbonate white lead; others are 100 per cent. zinc oxide or 100 per cent. lithopone. Still others consist of basic carbonate white lead, leaded zinc, and asbestine, or lithopone and blanc fixe, or leaded zinc, lithopone and whiting. Which you get, when you buy white paint, you must guess. At a future time, I hope to discuss this question at greater length.

I have outlined only in a very cursory way a few things that may be said about pigments, and if I have told you anything you did not previously know, or if I have revived long-forgotten facts in your mind, I shall be glad.

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*Address delivered before the Ottawa Branch, Society of Chemical Industry, February 20th, 1919.

A Process for Electrolytically Refining Nickel.*

By Geo. A. GUESS, Professor of Metallurgy, University, of Toronto, Canada.

If an anode of crude nickel, which may contain copper and iron, is electrolyzed in a bath of nickel sulphate in which is suspended finely divided calcium carbonate, there is deposited on the cathode, if suspended in a sack diaphragm, metallic pickel practically free from copper and iron. This is the basis of a process developed in the Metallurgical Laboratories of the University of Toronto. The action of the finely pulverized limestone appears to be represented by the following equation:

$$2\ CuSO_4 + 2\ NiSO_4 + 3\ CaCO_3 =$$
$$2\ CuO.\ 2\ NiO.SO_3 + 3\ CaSO_4 + 3\ CO_2$$

The copper is precipitated as a double basic sulphate of copper and nickel; which is quite insoluble. The function of the diaphragm is to protect the cathode from mechanical pollution by contact with the insoluble copper salt.

Since an equivalent amount of nickel is combined with the copper in the insoluble basic sulphate, it is obvious that the copper content of the anodes should be as low as possible. Preliminary treatment of the converter matte to remove copper is necessary. Two methods at once suggested themselves for doing this. The first is by leaching the roasted matte with dilute sulphuric acid, as is done in the preliminary operation for the Mond process. The second method would be a fusion with coke and salt cake (Na_2SO_4), which is the preliminary step in the Orford process. The data herewith submitted were obtained in refining anodes produced by the first method.

The matte used had the following analysis: Ni, 56 per cent.; Cu, 24 per cent.; S, 18 per cent. It was crushed to 40 mesh (0.6 mm.) and roasted. The calcines were leached with 8 to 10 per cent. sulphuric acid solution. There was thus extracted 50 per cent. of the copper and a small amount of nickel. The dried residues were mixed with charcoal, fused and cast into anodes. These anodes contained Ni, 79.8 per cent.; Cu, 18.0 per cent.; Fe, 2.0 per cent. The anodes were 5½ x 5½ inches (14 x 14 cm.), and had two lugs, which were drilled and tapped for copper rods. Each anode weighed approximately 1,900 grammes, and two anodes were used in each tank.

The cathodes were sheet lead or sheet aluminum 6 x 6 inches (15 x 15 cm.). There were three in each tank, suspended in a bag of light canvas, which was pulled over a wooden frame in order to keep it distended.

The electrolyte was a solution of nickel sulphate usually kept at from 5.5 to 6.5 per cent. nickel (110 to 130 lb. (50 to 60 kg.) nickel per fluid ton). The temperature of the electrolyte was maintained between 40° and 50° C. In starting a new tank 3.5 per cent. (70 lb. per fluid ton) of ordinary calcite crushed to 200 mesh (0.125 mm.) was added to the electrolyte. The solids were kept in suspension by circulation by a pump which discharged into a small lead tank resting on a hot plate, and from which the electrolyte flowed by gravity back to the stoneware tank. Limestone at 200 mesh (0.125 mm.) was added hourly to the electrolyte. The amount added was based on the rapidity of solution of the anode. Calculated back to the original matte the quantity of lime-rock used ranged between one-half and three-quarters of a ton of limestone per ton of matte. Necessarily, more limestone was needed than the equation called for. A small amount of glue was used in the electrolyte.

A current density of 13 amperes per sq. ft. (143 A. per sq. m.) of cathode gave excellent nickel. The potential required was 2 volts. The ampere efficiency at the cathode was 98 per cent., at the anode sometimes slightly over 100 per cent.

In practice there would be removed regularly from circulation a portion of the accumulated mud, in order to keep the percentage of solids constant. This mud, after washing, showed on drying Ni, 8.28 per cent.; Cu, 9.10 per cent.; S, 8.88 per cent; CaO, 30.1 per cent.; Fe, 1.4 per cent. Fusions were made of this mud with silica as flux, in graphite crucibles. The product was a slag; SiO_2, 48 per cent.; CaO, 38 per cent.; and a matte containing Ni, 36.1 per cent.; Cu, 37.8 per cent.; S, 19.5 per cent.

The procedure suggested is to roast this matte, then reduce and cast it into anodes. These anodes will be used in copper refining tanks using the copper-rich acid liquor from the leaching operation. Good cathode copper can be produced until the copper content of the electrolyte is reduced to 1.5 to 1.7 per cent. copper. Not enough of this mud was obtained to furnish material for such anodes in a copper tank. Anodes made from other sources were used. A current density of 12 amperes, at 0.35 volt, was used. Insoluble lead anodes were used after the copper was reduced to 1.47 per cent. The potential for the same current was now 2.2 volts. From 1.47 0.054 per cent. Cu, the ampere efficiency was 66.2 per cent., during the final reduction to 0.0115 per cent. Cu the ampere efficiency was 46.7 per cent.

The copper department in such a refinery would receive the leach liquor from the roasted matte; would electrolyze this with anodes made from the mud in the nickel department. When the copper content of the electrolyte reached 1.5 per cent., the solution would be electrolyzed with lead anodes to remove most of the copper. It would then go to evaporating pans and crystallizing tanks. The mother liquor containing the acid and the rest of the copper would be used for further leaching. The crystals would go to the nickel department.

The crude nickel anodes would be received in the nickel house. Electrolytic nickel would be produced, and a lime mud which would carry away a chemical equivalent of nickel. This nickel would be returned from the copper house as nickel sulphate. In addition to this there is required an amount of nickel as nickel sulphate, the chemical equivalent of the copper in the anodes, since this amount of nickel is plated at the cathode while the copper in the anode is being dissolved. The copper house is required to supply then 117.4 lb. (62.5 kg.) of nickel as nickel sulphate for every 63.5 lb. (28.8 kg.) of copper in the anodes. To obtain this some of the nickel house anodes may be electrolyzed in the copper house, to supply any nickel sulphate not made up by the amount of nickel leached out from the roasted matte. The amount of acid required is similarly twice the chemical equivalent of the copper in the nickel-house anodes.

The rare metals platinum and palladium, which occur, do at present prices form an important constituent[3] of these mattes. These metals are retained in the slime which forms an adherent crust on the anodes, and does not tend to fall off. The slime, if desired, may be obtained for the most part free from the lime mud.

No laboratory work was done using a salt-cake fusion. Anodes made after such a fusion might be taken as having from 2 to 5 per cent. copper. The amount of mud made would be correspondingly small, and this might be returned for salt-cake fusion with the original matte. The nickel sulphate required would come from the electrolytic refining of the copper made from the "tops."

Nickel cathodes free from iron and containing as little as 0.01355 per cent. copper were made. A small amount of unprecipitated copper was always found in the electrolyte. It was always very small, often only 0.001 per cent. Cu. The double basic sulphate is easily filtered, i.e., it is easily retained on any filter paper. Bags of light canvas were found more satisfactory than heavy material.

[3]Ontario Nickel Commission report, p. 486.

*A paper presented at the Thirty-fifth meeting of the American Electrochemical Society, New York, April 3, 1919.

MEETING OF ONTARIO SCIENCE TEACHERS.

On April 22nd and 23rd, the annual convention of Ontario teachers was held in Toronto and resolutions of far reaching importance were passed. Evidence of various types of University training is shown in lines of special work found most interesting by different teachers. Those who took special work in biology, geology or chemistry during their college career naturally show more interest in these sciences afterwards. The question of making a general survey of the teaching of science in all schools and universities in the Province was brought up in a motion to this effect which will be passed on to the Department of Education for action and consideration as they see fit. Such a survey or stock-taking would be more profitable now as we must make sure of our position during the rapid growth of technical education along all lines.

The idea was put forward and supported by University Professors that the high school teachers and those particularly interested in forestry, biology and geology could do much useful work of an original nature in local districts. Much data could be gathered and important studies made in the life history of various animal and plant groups about which we know but little now. For those specially interested in Chemistry and the industrial applications of science it was thought that a movement might be started whereby the teachers in the secondary schools would be encouraged to undertake definite problems, either of a theoretical or practical nature connected with industries in their localities. With the research spirit properly developed, this also would seem to be a very excellent way to disseminate ideas of value among smaller industrial organizations. The right teacher could develop work of this kind to the advantage of his regular classes..

The whole matter was presented by A. D. Hone, M.A., in the form of resolutions addressed to The Advisory Research Council, Ottawa; The Universities, and the Department of Education. These resolutions as presented were

(1) To the Department of Education:

That the Department of Education, recognizing the value of research work to the country and as an inspiration to the students and teachers, do all in their power to encourage research work.

That, with this end in view, the Department make it clear to the School Boards, that it is their desire that the teachers have full use of the school laboratory and apparatus for this purpose.

(2) To the Universities:

That the Universities give every encouragement to Science Masters wishing to engage in investigational work.

That, with this end in view, the professors in the various Science Departments submit to the executive of the association a list of problems for research, with which they may meet from time to time.

That upon a suitable and qualified person expressing a willingness to undertake the investigation of a problem, the professor concerned direct the investigation at the expense of the University.

That the Universities give greater opportunity for the obtaining of post-graduate degrees in science by extramural and summer school work. That they place their libraries at the disposal of teachers engaged in research work, and that the teachers doing such work may feel free to consult the professors concerning it.

(3) To the Research Council:

That, upon the establishment of a Research Institute, the Honorary Advisory Council, or the Director of the Institute, make some provision for the carrying on of research work by the Science Masters of the Dominion, in co-operation with the workers there.

That for the present, the Research Council recognizing that the training of the Science Masters is, in many instances, in no wise different from that of those at present engaged in this work, give every encouragement to those teachers wishing to engage in research.

That, with this end in view, the Research Council submit to the Executive of this Association a list of problems awaiting solution, to be submitted, in turn to the Science Masters.

That, upon the selection of a subject from the list or elsewhere, the Research Council, if it approve of his subject qualifications and arrangements for so doing, bear the expense of such investigation, as an assisted research.

That the arrangements for obtaining literature, assistance, etc., be left in the hands of the teacher, subject to the approval of the Research Council.

That the teachers endeavor to aid the industries in their own locality by finding out any problems awaiting solution and that they bring these matters to the attention of the Research Council, who, if they think it desirable, will extend aid in the solution of them."

This is a new phase of the general problem of stimulating research thinking in Canada and is worthy of all the support possible. As a branch of our educational system money expended in support of these ideas will be well spent.

A council for the direction of technical studies has been formed in connection with the Montreal Technical School. Its membership consists of a number of the professors and lecturers of the staff who are interesting themselves in the bettering of technical education in Quebec, with a view to increased powers of production. Its objects will be to understand thoroughly the economic situation in the province and to inaugurate a program of propaganda which will bring before the public the necessity and advantages of technical training. A request for official recognition for the new council was recently brought before the Legislature at Quebec. Gaspard De Serres, President of the Montreal Technical School, is the patron. A. Macheras, principal, is the president of the council. Its members are: Profs. Belanger, Chartier, Cing-Mars, McLeish, Landreau, Bailey, Corcoran, Tanner, and instructors: Messrs. Gratiot, Roberge, Boisjoli, Jacques, Morgentaler, Gourdin, Braem, Massicotte and Cadieux.

THE MANUFACTURE OF OLEOMARGARINE*

The enormously increased consumption of oleomargarine in the United States in the last year proves to a greater degree than any argument possibly can the popularity of this article. Expressed in figures, 152,000,000 pounds were consumed in 1916 and 232,000,000 pounds in 1917, while estimates from a reliable source place the 1918 figure at 350,000,000 pounds. Received with hesitation at first by the public, objections have been overcome in a surprisingly short time.

In speaking of oleomargarine, reference is made not only to that class of margarine which contains oleo (animal) oils, but to that comparatively new product termed "nut margarine," which contains only vegetable oils.

The principal difficulty experienced with some manufacturers of nut margarine is that they are unable to keep the melting point above 75 degs. Fahr., while butter melts about 92 degs. Fahr. However, it is claimed by one manufacturer that his nut margarine has a melting point of 107 degs. Fahr. This possibly can be accounted for by the use of hydrogenated oils.

Nut margarine is being made by the same process and with the same equipment as oleomargarine; in fact, the federal laws which govern the manufacture of this product class both oleo and nut margarine as "oleomargarine," and the containers for them must be so labeled.

Composition of Oleomargarine.

All oleomargarine has for a base hard and soft oils. The soft oils are generally kept in storage tanks which have their outlet convenient to discharge into a tank set on a movable scale. It might be said that all of the ingredients of oleomargarine are proportioned by weight. The hard oils are weighed and placed in melters. These melters, which are equipped with agitators, are tin lined, and have a capacity of 3,000 pounds each. The water jacket which surrounds them is kept at a temperature of about 125 degs. Fahr.

Churning the Product.

The melted hard oils and soft oils are conveyed through sanitary pipes to the emulsion churn. Here they are mixed with sterilized and pasteurized milk, conveyed through an open tin trough. Open troughs are used to facilitate thorough cleansing. These churns have two sets of driving pulleys, to permit reducing the speed one-half from the countershaft. They are also tin lined and have a capacity of 2,600 pounds, and are surrounded on the sides and bottom by a water jacket.

A new type of underdriven churn has recently been developed which has all the driving machinery located in a cast iron base, leaving the top of the churn as well as the entire floor free from driving machinery. This is a long stride toward sanitation as yell as preventing accidents.

The batch is churned from 12 to 18 minutes in these machines, depending on the grades of product, the longer time being required for a higher grade product containing a relatively high percentage of milk. The water jacket temperature varies from 86 to 125 deg. Fahr., the higher temperature being required for the lower grade product in order to keep liquid the materials used.

Automatic temperature control of the water jacket is now being used with considerable success. This control consists of an air-operated, thermostatic-controlled device with means of quickly changing the setting. The use of this device eliminates all guess work in keeping the water at the proper temperature.

After churning, the batch is discharged through a wood chute or flume. At the end of this flume a wide flat nozzle sprays cold water on the emulsion, solidifying it. The water pressure in this nozzle varies from 10 to 20 pounds, depending on the color of the product, and the temperature of the water should be between 36 deg. and 44 deg. Fahr., depending upon the quality of the product.

Ripening and Working.

Wooden trucks with removable bodies having a capacity of about 900 pounds are used to hold the oleomargarine, the purpose of making the bodies removable being to facilitate steaming and cleaning. No metal comes in contact with the oleomargarine from the time it is solidified until it is placed in cartons or tubs. The loaded trucks are next pushed into a room, the temperature of which is kept close to 70 deg. Fahr. Here a chemical change takes place which produces a certain flavor; this change is technically described as ripening.

The ripened oleomarbarine is then placed on large circular workers or kneading tables about 8 feet in diameter, where the excess moisture is removed and dairy salt added. It is sometimes found at this point that the product contains a low percentage of moisture, and to remedy this it is worked in a blending machine, where the proper amount of moisture is added. This blending machine also serves the purpose of bleaching oleomargarine which has too deep a color. Some of the States prohibit the production or importation of oleomargarine having a yellow color, as does the Canadian Government.

The average manufacturer of oleomargarine produces about 60 per cent. prints and 40 per cent. bulk or in tubs, varying with the kind of trade and time of year. A recently developed machine forms and cuts the prints to size and weight. This machine has a capacity of 25,000 pounds per day and requires only a one-horse power motor to drive it.

Essentials for Success.

The manufacture of oleomargarine requires care at every step to obtain proper flavor and grain. Absolute cleanliness is essential, and to this end all machinery, containers and utensils must be frequently and thoroughly cleaned and sterilized, making generous use of steam and hot water. Absolute cleanliness in respect to body and clothing should be insisted upon. It is customary to employ a manicurist to take care of the hands of all those who can possibly come in contact with the margarine. Wooden paddles and shovels should be supplied for those who handle the prdouct.

It should also be remembered that it is impossible to make acceptable margarine with improperly refined or deodorized oils or rancid fats. Before shipping the manufacturer should test his product for color, curd, fat, moisture, and salt and grade accordingly. Experience is necessary to the successful manufacturer of butter substitutes, as numerous and widely varied conditions are to be carefully considered. A wide variety of formulas are used. Those containing cream and some butter are of course rated higher than those made from oleo oil, cotton seed oil, neutral lard or stearine with skim milk or butter oils.

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* (From the American Food Journal by E. B. Kufler, Chief Engineer, Mechanical Manufacturing Co., Chicago.)

AMERICAN CONVENTION REPORTS

An account of recent meetings of the American Electrochemical and Chemical Societies

There was a large attendance at the 35th General Meeting of the American Electrochemical Society, held at the Chemists' Club, New York City, April 3, 4, and 5.

This was the first convention of the society since the end of the great war and President F. J. Tone in his address referred to the fact that the war had not, as was feared, a deleterious effect upon the society, but had been a real stimulus to its activities. The growth in membership had been good, namely, 345 with losses 122 or a net gain of 223, with an additional gain of 25 since January 1st, making the total membership now 1,928. The financial assets were satisfactory: Liquid assets about $20,000; live assets (largely reserve copies of the transactions) $20,000.

The report of the Board of Directors dealt with the usual matters, but one important action was taken, namely, the dropping of all alien enemies from the membership of the society.

The report of the Secretary, J. W. Richards, showed that during the year two honorary members had been elected, the first to be elected, Charles F. Chandler, and Edgar F. Smith.

Public Relations Committee.

The Committee on Public Relations presented a report recommending the society to go on record as opposed to Government operation of hydro-electric systems in the United States. This report was adopted with some opposition. As an appendix to the report, there was a paper by F. A. J. Fitzgerald, who went into the financial considerations in great detail, declaring that there were defects in the Canadian Government ownership and operation of telephones, and referring to Professor Mavor's decision that the Manitoba experience with Government ownership was not favorable to the same, but declaring also that the best example of Government ownership of water powers was in the Province of Ontario.

The address: Retiring President F. J. Tone made a deep impression on the whole convention, especially in his pointed remarks as to the results of the war on science. Referring to the need for greater production, Mr. Tone said: "Not forgetting such factors as co-operation, efficiency of organization and distribution and elimination of wastes, production can be increased principally in two ways, first, by using labor more efficiently, and, second, by further supplementing and supplanting labor by the chemical and mechanical instrumentalities of industries. Either we must get more out of labor or we must stimulate the discoveries that will make labor more productive than before. If the world is going to work less, science must work more. The work of the world cannot be done in a six-hour day and a thirty-two-hour week unless applied science gets in a lot of time-and-a-half on week days and double time on Sundays."

Reading of Papers.

Dr. E. F. Northrup, who has recently perfected a new type of electrodeless electric furnace at the Palmer Physical Laboratory, at Princeton, for the Ajax Metal Co., gave the theoretical principles involved in inductive heating.

Dr. S. C. Lind, of the Bureau of Mines, Golden, Col., sent a written discussion on Gustave Gins' work in the extraction of uranium from pitchblende, calling attention to the fact that oarnite is now the most abundant source of uranium instead of pitchblende, and that uranium is now virtually a by-product of Ra. Any process for U recovery which did not take care of Ra. recovery must be discarded.

During the discussion on the abstract in electroplating, by Oliver P. Watts, W. D. Mainwaring called attention to the great importance of cleanliness, not only of the objects to be plated, but also of the tanks which must be cleaned often, and kept clean and covered. The copper method is the best. The deposit of nickel on steel is influenced by the amount of current, which should be regulated so that no hydrogen is deposited with the Ni. while making some lead platings. Mr. Watts observed that heavy pitting suddenly and irregularly appeared, which was found to be air dissolving in the electrolyte. This difficulty was overcome by heating the solution to a little above its working temperature by means of a lead steam coil before resuming plating, whenever the tanks had been out of use for any considerable time.

Other papers given, all excellent in tone, were: "Notes on Electro-Static Precipitation," during the discussion of whch paper Dr. S. Dushman expressed the belief that the Kenetron was more practical in current rectification than indicated by Mr. Braley. C. F. Carrier, of the American Cyanamid Co., gave history and construction of the Nelson Electrolytic cell. "The oxidation of ammonia to nitric acid," was treated by W. S. Landis, M.S., who stated his belief that during the war, Germany produced all her HNO_3 as Na No_3. "Silicon Tetrachloride," by O. Hutchins; "The Edgewood Arsenal," by W. H. Walker; "Role played by Silicon and Titanium Tetrachlorides during the past war," by G. A. Richter; "Power Production for Electro-chemical Purposes," by C. S. Cook; "The Electric Furnace: Its introduction into foundry practice," by W. E. Moore; and "Preparation of Fluorine," by W. L. Argo, F. C. Mathers, B. Humiston and C. O. Anderson. The election of officers for 1919 resulted as follows:—

President, W. D. Bancroft; Vice-President, J. V. N. Dorr; W. R. Whitney, C. Hering; Managers, H. C. Parmelee, R. E. Zimmerman, E. Blough; Treasurer, P. G. Salmon; Secretary, J. W. Richards.

Meeting of American Chemical Society at Buffalo.

The post-war period of the Society was fairly entered into at Buffalo at the regular spring meeting. The tension of previous meetings was over, and the Society found itself in the midst of a transition period from war to peace.

The council meeting opened the Convention on Monday, April 7th, with a large attendance. In the evening session, it was proposed that American chemists take up the preparation of data on physical and chemical constants, leaving to a British Commission the preparation of compendia on inorganic and organic chemistry. The French branch of the International Commission will continue its work on abstracts of constants. The extension of this international work was considered an important function of the Society.

At the general meeting on April 8th, several speakers of note were heard on tariff questions and the general protection of American chemical industries. Dr. Nichols, the president of the Society, pointed out the necessity for industrial chemists to guard their position by all means within their power.

In the tariff discussion, a sharp difference of opinion arose. Mr. Choate, of the Chemical Foundation, favored the license system, while Hon. W. S. Culbertson was directly opposed, claiming that a proper tariff would be an adequate measure of protection.

Papers Presented.

A very nearly infinite variety of papers were presented to the different sections. A general symposium on mustard gas was given in the Technical High School on Tuesday. Among the very important papers were those given by Dr. Irving Langmuir, of the General Electric Co., who spoke on "The Arrangement of Electrons in Atoms and Molecules," and Prof. H. S. Taylor, of Princeton, on "Preferential Catalysis on the Purification of Hydrogen." Some idea of the matter presented to the various sections may be realized when it is understood that at least 134 papers appeared on the printed program.

The Entertainment Committee.

Absolutely nothing was lacking. The smoker and banquet were exceedingly successful affairs, indeed. The guiding genius was Mr. F. A. Lidbury. On both occasions, he made light of very heavy roles. His "Oxometer" is a distinct contribution to scientific apparatus industries.

Plants Visited.

For many, the greatest interest in such conventions is the opportunity presented for visiting well-known and large industrial plants. The program gave every facility for looking over the plants of large Buffalo companies. On Wednesday, a trip was made out to the Pumping Station and Emerald Channel Intake. Here the chlorination of the city water supply was shown. No filtration system is employed.

National Aniline Co.

On Thursday afternoon, a rapid trip was made through the works of the National Aniline & Chemical Co. The magnitude of the operations carried on was strikingly evident. Production has increased at least ten times during the war and America has been provided with many essential dyes from this plant. The research and dye-testing laboratories were also thrown open to the visitors.

Buffalo Foundry and Machine Co.

From this plant, automobiles hurried the visitors off to the works of the Buffalo Foundry & Machine Co. The transition could not have been more complete. From the complicated machinery used in the organic processes to the large-scale machinery used in the foundry was, indeed, a change, and is a typical indication of the great variety of operations going on under the name of one industry. Very fine guiding pamphlets were given out, and a most instructive hour spent right in the plant observing various large-scale operations in melting and casting iron. The limits of the plant are the limits of railroad facilities, bridge heights and car capacities. The greatest care is taken to secure proper alloys and much of the trick depends on the heat of the pour and the time of cooling.

Spencer, Kellogg & Sons, Inc.

Here the production of raw linseed oil was shown and the process followed from the grinders through the filter presses and into the tanks.

Pratt & Lambert, Inc.

This up-to-the-minute plant proved very interesting, indeed. Various operations were followed through and the system of chemical control explained. Labor-saving devices were in considerable evidence and parties were conducted carefully over all portions of the plant from the stocks of raw materials to the shipping point.

The Lackawana Steel Co. and the plant of the Larkin Co., soapmakers, were visited by many on Friday.

Niagara Falls Industries.

Many spent one whole day at Niagara Falls, where a succession of electro-chemical industries offer attractions on a par with the scenic beauty.

It is estimated that some 1,100 members and guests attended the Convention.

RECOVERY OF MOLYBDENUM FROM WASTE WASHINGS OF PHOSPHATE DETERMINATIONS.

The filtrates from phosphate determinations are treated with an excess of sodium or calcium phosphate. After standing for a long time at 70-80 deg. C., the yellow precipitate of phosphomolybdate settles completely; it is filtered, washed and air-dried. It is then dissolved in an excess of concentrated sulphuric acid and the solution heated until completely decolorized and white fumes are evolved. The heating is stopped and the solution allowed to cool. There often separates out at this stage a white precipitate, which is subjected to all the subsequent operations. The solution is poured into a volume of water, eight to ten times as large as that of the sulphuric acid used, and the molybdenum is precipitated hot by an excess of potassium ferrocyanide. After the solution has stood three hours, the precipitate is filtered off and washed with very dilute potassium ferrocyanide solution until free from sulphuric acid. It is then dried, separated from the filter, heated until the mass begins to fuse, and treated twice with boiling water. The molybdic acid is dissolved in ammonia, leaving a residue of iron, iron oxide and carbon. The colorless solution is filtered, evaporated to dryness, redissolved in a small amount of water containing 1-2 cc. of ammonium persulphate or of hydrogen peroxide to oxidise to molybdic acid any lower oxides of molybdenum, the excess of the oxidising agent being decomposed by boiling. The ammonium molybdate solution thus obtained can be used for the precipitation of phosphoric acid.

For the quantitative separation of molybdenum from phosphorus, the substance to be analysed is dissolved in sulphuric acid, as above described, and the molybdenum is precipitated in dilute solution by means of sulphuretted hydrogen. The remainder of the determination is carried out according to the method described in Treadwell.—S. Malowan, in Chem. Ztg., XLII., Nos. 101-102, Aug. 24th, 1918, through Chimie & Industrie, II., No. 2, Feb., 1919.

RENDERING PEAT COMBUSTIBLE.

The following process has been brought forward by S. C. Davidson, of Belfast.

The peat is first disintegrated, and 15 per cent. of pitch is added and mixed in. The whole is then subjected to a hydraulic pressure of at least 140 kg. per sq. cm. (nearly 2,000 lbs. per sq. in.). The volume is thereby reduced to about one-third of what it originally was, and the material comes out of the press as a briquette, which looks like highly-polished hardwood. It burns with a yellow flame. Before being treated, the peat must be air-dried for a certain time.—Chimie & Industrie, II., No. 2, Feb., 1919.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa.

(*Notice.*—Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, they may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

Department of Trade and Commerce.

Dominion Bureau of Statistics.

Monthly Trade Report of the Trade of Canada. January, 1919, 365 pp.

From this table of imports and exports, it is apparent that our imports for the month of January this year were about thirteen million dollars higher than for the same month of last year. For the ten months of the fiscal year, however, ending with the month of January, our imports at $780,576,737 compare favorably with those of the same period of last year, which were $823,059,701. Our exports for the same two periods show a drop. The figures are $1,075,834,460 for 1919; $1,392,685,908 for the ten months of 1918.

The trade of Canada by months is given *in toto*, with the United Kingdom, with United States, and the imports and exports are given by articles, by classes, and with regard to the countries with which we did business.

Few appreciate just how complete the publications of the Bureau of Statistics are, and the fact that they are "blue books" should not prevent people from perusing them much more than is now done. Many intelligent folk complain bitterly about the way in which the Government neglects to give them the information which they think they ought to have, but very often the data asked for have been compiled for years, and are available to any one who has sufficient energy and interest to ask for the publication or to look in any of our many public libraries.

Monthly Bulletin of Agricultural Statistics. January, 1919, 28 pp.

Areas, yields, qualities and values of the principal field crops for each of the years from 1915 to 1918, inclusive, take over half of this issue of this little monthly, which is attractively printed to show just what it purports to show, namely, agricultural statistics. Reports on the conditions prevalent throughout Canada in farming communities, coupled with a few notes on wheat prices complete the publications.

Weekly Bulletin.

In the bulletin issued on April 14th, there are two pages given to listing blocks of electrical power available for sale in Canada. This list has been prepared by the Dominion Water Power Branch in co-operation with the Dominion Bureau of Statistics. The grouping is according to provinces and the nature, amount, rates and accessibility to transportation are given in detail.

Canada Food Board.

Report for the Year 1918, 87 pp.

Excellently printed on buff paper and bound in brown covers, with red titles, this effort of the Canada Food Board reflects the expenditure of over half a million dollars during the past year, as well as the credit balance of nearly forty thousand dollars, with which it finished up its work. Part I. of the Report deals with the mehods followed in carrying on the work of the Board, while the sectional reports are given place in Part II. The third section is replete with charts on the cost of bread and butter and milk, indexes of various Food Board activities, prices, etc. It is presumed many people who wondered about the big organization will be glad to procure a copy for their enlightenment.

Department of Mines.

Geological Survey.

Summary Report, 1917, Part A, 19 pp.

"Part A" contains the report of the Directing Geologist, reviewing the work of the Geological Survey for the year. It contains lists of reports and maps published during the year, and is accompanied by a table of contents for all parts of the annual Summary Report. This system of publishing the annual report in parts seems to be a very desirable one in that the subjects treated are often quite different, and hence interest different people. It makes further for better availability, as far as the ordinary reader is concerned, and these papers are probably given rather more attention than the same information all in one volume would be likely to receive.

Summary Report, 1918, Part B, 72 pp., 2 maps.

In this report, mention is made of the British Columbia office of the Geological Survey, which was established in Vancouver in June of last year. Charles Camsell is in charge of the office, and his work there is meeting with favor. The chief purpose of the office is to keep in touch with driling operations in the Province throughout the year, to keep the Federal Department in closer touch with the Provincial Departments and to serve as a centre for the distribution of mines publications. The list of reports published in this issue is as follows:—

The British Columbia Office.

Mayo Area, Yukon, W. E. Cockfield.

The Silver-Lead Deposits of the Twelve-mile Area, Yukon, W. E. Cockfield.

Mercury Deposits of Kamloops Lake.

Boring Operations for Oil in the Vicinity of Vancouver, B. C.

Copper Mountain, Gun Creek.

Platinum Investigations in British Columbia.

(These four papers by C. Camsell.)

Platinum Situation in Canada.

Quatsino Sound and Certain Mineral Deposits of the West Coast of Vancouver Island, B. C., By V. Dolmage.

Cariboo Gold Fields, B. C., B. R. MacKay.

Britannia Map-Area, S. J. Schofield.

Ainsworth Mining District, B. C., S. J. Schofield.

Lardeau Map-Area, B. C., M. F. Bancroft.

There is also an index to the subject matter.

Regarding the mercury deposits, the writer says: "With properly-conducted prospecting an ore-body of economic value might possibly be developed." The platinum situation will be discussed in Part G of the Summary Report for 1918, which has not yet been received. It is expected that as a result of the Government activities, however, the production of platinum should be increased next year

Salt as a Base of Chemical Industries

Works of the Canadian Salt Co., and their relation to Industrial Developments

That "salt is good" is a saying approved by the universal demand for that article, and it now has a new significance, when considered as the base of certain chemicals, without which modern industries could not be carried on. In the raw material for these chemicals, Canada has in the south-western peninsula of Ontario a national asset, whose importance we are just beginning to comprehend. That we are rather late in realizing this is evident from the fact that at the beginning of the war the salt production of Canada was only about one-fiftieth that of the United States. It is growing, however, the output being slightly over 45,000 tons in 1891, nearly 60,000 tons in 1899, 116,600 tons in 1915, and 131,114 tons in 1918, the proportion converted into chemicals accounting for a large part of the recent increase. Some conception of the extent of these deposits of rock salt may be gained by the statement that the land on both sides of the Detroit and St. Clair Rivers is underlain by a bed of salt, reaching in some places—as at Windsor—a thickness of 200 feet. On the Ontario side, this bed extends east as far as London, and from London north beyond Kincardine, the enclosed area east of Lake Huron, and south to Lake Erie, being about 3,000 square miles. Beyond the rock-salt bed are areas containing brines of greater or less density. The deposits of rock salt encountered at depths varying from a few hundred to nearly two thousand feet are apparently about four times as great on the Ontario side as on the Michigan side. At all events, the salt supply and the supply for chemicals based upon salt are ample for a population many times the present population of Canada. It is estimated that beneath the land near the plant of the Canadian Salt Co., there are 400,000,000 tons of salt per square mile. Then there are great salt deposits, as yet unexplored, in the prairie provinces and in Nova Scotia.

View of Chemical Plant of Canadian Salt Co. at Sandwich, Ontario.

From Salt to Chemical Industries.

To the Canadian Salt Co., who were for thirty years manufacturers of salt for domestic and commercial purposes, is due the credit of establishing the chemical industries, such as caustic soda, bleaching powder, chlorine, cleansing materials, etc., based upon salt. The report of the Ontario Bureau of Mines refers to this industry as one that "promises, in a few years, to become one of the largest in the British Empire."

The chemical plant of the Canadian Salt Company, located at Sandwich, was erected in 1910 to supply Canadian trade with these products, all of which, up to the spring of 1911, had to be imported from the United States or Europe.

The electrolytic process, selected as being the most efficient, was the same as that developed and operated by the present works manager of the Canadian Salt Company, while at the Wyandotte plant of the Pennsylvania Salt Manufacturing Company.

The principles involved in the operation are the same as in the various electrolytic caustic plants at Niagara Falls, and elsewhere in the States. Such differences as exist are in special details of construction and operation.

Saturated brine from the salt wells is treated to remove the small amount of lime always present, and is run constantly into the cells, where the salt is decomposed by the electric current. Chlorine gas is liberated at the surface of the graphite anodes, and passes from the cells into stoneware pipes, which conduct it to the bleach chambers or such other uses as may be required.

The sodium liberated at the cathode immediately reacts with the water of the brine to form caustic soda, which escapes from the bottom of the cathode compartment in solution in the brine, still carrying a certain amount of undecomposed salt. The aim of the operator is to so regulate conditions as to prevent to the greatest degree possible the formation of hypochlorites and chlorates, which not only reduce the efficiency of the process, but also reduce the life of the graphite anodes.

The liquor from the cells is next evaporated in vacuum remove the residual salt, which, being insoluble in the pans to concentrate the caustic solution, and t_o incidentally strong caustic solution, crystallizes out, and is separated from the caustic by filtration. The salt is then washed free from caustic, and may be redissolved and returned to the cells or sold as desired.

The strong caustic solution still carrying fifty per cent. of water is finally run to large cast-iron pots, which are heated to such a degree as to drive off the remaining water, leaving the molten caustic, which is poured into steel drums, and allowed to solidify, in which condition it is ready for the trade.

For the manufacture of bleaching powder or chloride of lime, the chlorine gas from the cells is conducted to large chambers of lead or special concrete construction, upon the floors of which is spread freshly-hydrated lime. The gas coming in contact with the lime is absorbed, forming calcium hypochlorite, or bleaching powder—the so-called chloride of lime of commerce.

One of the principal costs of the process is the power required, and with the increasing cost of steam power due to the advance in coal and labor, it has become necessary to introduce hydro power, which is received at the plant at 26,000 volts, stepped down in transformers, and run through two 2,000-k.w. rotary converters, to produce the direct current power required for the cells.

The plant started operating in the spring of 1911, and is now three times its original size, the number of cells being now 750. Part of the chlorine made is now being used in the preparation of organic chlorides for the production of benzoic acid, and other substances, which are produced through the instrumentality of chlorine, and the Research Department of the Salt Company is at work on other uses of the chlorine gas.

Mr. Lafayette D. Vorce, the works manager is responsible for the development of the special type of cell used in these works, and the present improved form is the result of years of study and practice, starting with the plant at the Pennsylvania Salt Company. When Mr. Vorce went to those works in 1905, there

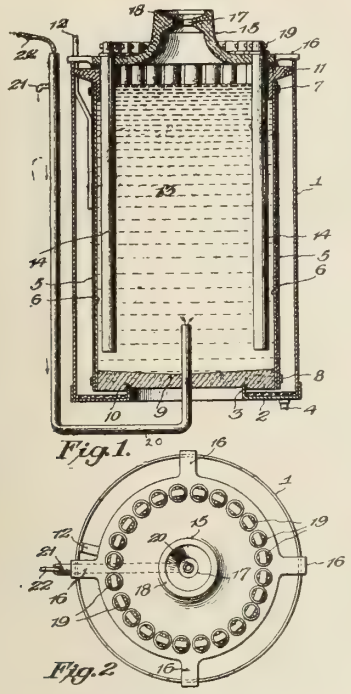


Fig. 1.

Fig. 2

Type of Cell Used.

were ten cells of an experimental kind in use, and when he left to come to the Canadian Salt Co., these had been increased to 2,600. The accompanying diagram shows the features of Mr. Vorce's invention. Where other types are rectangular, these are cylindrical, and are more easily made, more cheaply repaired, and more quickly taken apart for cleaning. At first, the top and bottom had rims of cast iron, covered with hard rubber; and twenty parts were used in the construction to prevent the leaking of caustic; but these complications have been largely done away with by a simple flange, the dome now being carried on the container; and the weight of the cathode pot, with the brine it contains, being carried on the bottom of the casing. This bottom may be a simple disc of concrete, and the cover also of concrete, its weight being carried by lugs resting on the outer casing. This permits easy lifting by a crane.

Canadian material and equipment were used in these works, as far as possible. At the Sandwich plant, the motive power is supplied by two triple-expansion, verticle engines of 720 k.w. each, equal to about 1,000 horse power. There is also a 750-h.p. Corliss engine for heavy duty for general power purposes. All three engines are from the works of the Goldie, McCullough Co., of Galt.

The production of salt by the vacuum process has largely displaced the slower and more expensive method of evaporating the brine in open pans. The sole advantage of the older process lay in the formation of coarser crystals than are formed by the rapid evaporation taking place, where the brine is boiled under reduced pressure in closed vacuum pans. Since the necessity for coarse salt is of small consequence for most purposes, fine-grained, vacuum-pan salt has taken its place to a large degree.

A typical plant of this style is that operated by the Canadian Salt Company, at its Windsor plant. This plant consist of two 12-ft. pans used as first effects and one 20-ft. pan as second effect. The smaller pans are so arranged that the steam vapor from the boiling brine in the first effect passes to the heating belt of the second effect. Thus the heat contained in the live or exhaust steam introduced into the heating belt of the first effect passes into the brine and is used again in boiling the brine in the second effect, in this manner performing the service twice, instead of once only, as in open pans, where the steam escapes into the atmosphere. This is possible owing to the fact that the boiling point of the brine is reduced by maintaining a vacuum of about twenty inches on the brine in the first effect, and twenty-nine inches in the second.

View of Salt Plant, Canadian Salt Co., Windsor, Ont

Since salt is only soluble to the extent of 26.4 per cent. in water, it follows that the evaporation of the moisture from the brine results in a potential super-saturation of the brine, which throws the salt out of solution, and being heavier than the brine, it sinks to the bottom of the pan, where it is removed by a bucket elevator, submerged in a boot, at the bottom of the inverted cone, constituting the lower part of the pan. Owing to this limited solubility of salt in water, fresh brine can be fed continuously into each effect, and the salt removed during the entire length of the run.

The operation of such an outfit is comparatively simple. The complications that occur are due to the fact that wherever salt is found, it is accompanied by gypsum, which is soluble in the brine to the extent of one-half of one per cent., and this introduces a serious difficulty, by collecting on the tubes of the heating belt and preventing the easy passage of the heat into the brine. It is for this reason that two first effects are employed. It is customary to operate one of the smaller pans for a period of twelve hours, at the end of which time the retarding effect of the gypsum on the tubes will be felt to such an extent that it is advisable to change over to the other small pan, and open and drill the scale from the tubes of the one first used.

Since at a vacuum of twenty inches, the temperature of the steam entering the belt of the large pan or second effect is not so great as that entering the first, the scaling of the tubes is not so pronounced, and the large pan can be run proportionately longer before it is necessary to stop its operation for cleaning purposes.

The salt, which is continually removed from the bottom of the pans is discharged by the elevators into draining bins, from which it is subsequently removed to the storage floor of the warehouse for shipment, or further drying and preparation for table salt.

Economic Relationships.

The manufacture of chemicals from salt should be considered as a whole. Economy cannot be attained unless the main products can be used in the country and their production so balanced that there is no loss or waste. The limit of successful operation of the electrolytic cell is bounded by the amount of chlorine gas it takes care of. In practice, this gives about two tons of bleaching powder to one ton of caustic soda; but as there is more demand for caustic soda than for bleaching powder, it will be seen that the requirements during the war period (when chlorine and bleaching powder were specially required) are out of balance under peace conditions. The injustice now inflicted on the Canadian industry, in the view of the manufacturers is that the surplus bleaching powder is now being dumped upon the market under perilous conditions without control. As caustic soda goes into a greater variety of uses than bleach, further industries should be encouraged, and the home market safeguarded during their development. This is what is actually being done in the United States, Great Britain and France and is the logical policy for Canada.

The situation, as outlined in last issue, may be re-stated as follows:—

It becomes essential that what was demanded as vital to winning the war is now also vital, if these chemical industries are to be safeguarded during the era following the war. Otherwise, our last state will be worse than the first.

The preservation and sound development of the chemical and metallurgical industries becomes, therefore, not a question of tariff, but a question of national safety. A number of these established for war purposes at a cost of millions of dollars, now find themselves faced with a serious problem. As they were established by Government action and Government command, so they ought to be secured by Government intervention during the period of reconstruction. This is required by common justice, as well as plain logic. In Great Britain, France and the United States, the situation has been taken in hand by the control and regulation of imports affecting these industries. In Canada, there has been a laxness in this control, and a situation has developed which demands a wise foresight, if a crisis is to be avoided in the industries established at such heavy cost.

TESTING THE GASOLINE CONTENT OF NATURAL GAS.

The Bureau of Mines, Department of the Interior, has designed at its petroleum experiment station at Bartlesville, Okla., a testing apparatus for determining the gasoline content of natural gas. This apparatus is now in use and has been found to give exceedingly good results on gases containing as little gasoline as ten gallons per million feet.

A valuable feature of this apparatus is that with four compartments, the last compartment can be used as a test to see that the absorbing medium of the first three compartments has completely removed the gasoline from the gas. This is accomplished by keeping the percentage of saturation in the fourth compartment around a fraction of 1%. Under such a condition an individual test can be made on the discharge gases from the first three compartments in which the saturation almost always rises to a point between 1% and 11% of the total volume of the liquid.

In a test made recently by the Bureau to determine the value of certain gas in the notoriously dry gas field of Southern Kansas, the apparatus checked itself consistently, proving recoverable yields from ten gallons to sixty gallons per million.

The same apparatus is used in testing the residue gases which have been treated in absorption plants which also at times run as low as ten gallons per million cubic feet, but in general if the gasoline is extracted to twenty gallons per million feet, plant operation is considered very satisfactory and although part of these twenty gallons can be extracted by well-known methods, the cost of the installation necessary and the exceedingly close attention required and extra labor expenses, make it doubtful if real economy could be obtained by such procedure.

With this testing apparatus over one hundred and fifty tests have ben made by the Bureau on between forty and fifty different gasoline plants, mostly of the compression type, but also including a number of absorption plants and combination compression and refrigeration installations. Of these the sample compression plants showed the poorest extraction and indicated that practically all of them could profitably add an absorption unit to treat their residue gases. Plants using naphtha for blending stock are especially well situated to pass their high pressure through this medium, cases being known in which 50°—51° Be. naphtha is raised to 63° Be. by this method. Where naphtha is not used, or cannot be, a heavy cut of oil must be circulated and the gasoline distilled from it. The installations are not over expensive, considering the returns.

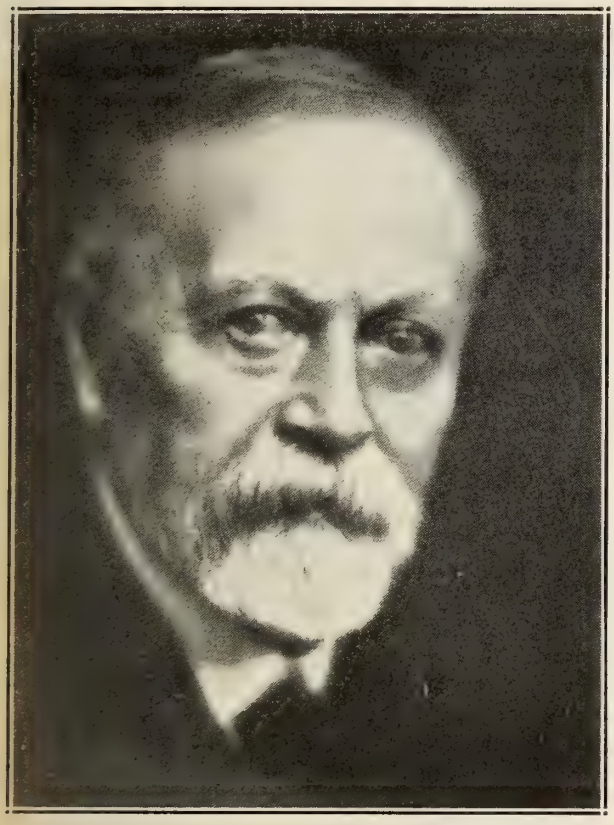
The testing apparatus has been used successfully in testing not only residue gases but those coming from coils used in condensing still vapors, gases from weathering tanks, blending and stock tanks, vapors from cars being loaded, and in fact any place where agitation causes evaporation losses of gasoline.

LAFAYETTE D. VORCE.

Mr. Lafayette D. Vorce, chief chemist of the Canadian Salt Co., whose works are described in this issue, received his first technical education at the Case School of Applied Science at Cleveland, Ohio. He was then placed in charge of the Standard Oil Company's laboratory at Cleveland, and later had supervision of that company's process of recovery of copper oxide used in removing the sulphur from Ohio crude oils. After six years he left to take charge of the oil extraction plant of the Cleveland Linseed Co., which carried on a wide range of extraction work in tankage, seeds and cereals. His experience here was put into practice in a garbage-reduction plant he built at Bridgeport, Conn., and a corn oil plant at Decatur, Ill. In 1905 he took charge of the erection and subsequent development of an electrolytic caustic soda and bleach plant for the Pennsylvania Salt Manufacturing Co., and it was during this time he developed the cell illustrated in this issue, and which is still in successful operation in Canada and the United States. Mr. Vorce is a member of the American Chemical Society, the American Electrochemical Society, the American Institute of Chemical Engineers, the Franklin Institute, and other societies, and is a past president of the Society of Detroit Chemists.

A TRIBUTE TO DR. ELLIS.

The Annual and Reunion Dinner of the Industrial Chemical Club of the Faculty of Applied Science, University of Toronto, was held in the Carls-Rite Hotel, on April 17th. The honoured guest of the evening was Dr. Hodgson Ellis, Dean of the Faculty, who is retiring at the end of this season after forty years of continual teaching service.



Dr. Hodgson Ellis, Dean, School of Practical Science, Toronto.

The evening will long be remembered, by those graduates and undergrads who were present to take part, as a landmark in the history of the school. During the dinner, excellent entertainment was provided under the direction of Mr. Jules Brazil. Following reinforcements of a culinary nature a program of toasts was introduced by Mr. J. H. Forman, the President of the Club. The faculty was upheld by Prof. E. G. R. Ardagh and Dr. M. C. Boswell. Both referred to the many ways in which Dr. Ellis had been a leader and director of Faculty work. Jovial tales were told of other days and special attention called to the new school of Engineering Research, which has been recently launched under the direction of Dean Ellis. Prof. L. J. Rogers pointed out the aim that should be striven for by science students and ably summarized the value of the type of knowledge that had been fostered for so many years at the School of Science.

A silent toast was given to those chemists from the school who had fallen for their country in the war—Lieut. H. N. Klotz, Capt. E. A. Twidale and Lieut. Knight.

Mr. W. H. Thom replied to the toast to the Club. He was the first Vice-President and pointed out that the Industrial Chemical Club had really been a big social factor in the life of the students during the ten years of its existence. In early days the chemists were few, but now they were well able to look after their interests in the larger school activities.

The event of the evening was of course the toast to the retiring Dean—Dr. Ellis. Professor J. Watson Bain who of all school men was probably best fitted to respond was present to do so. In a most impressive way he told the story of forty years development and the part Dr. Ellis had played in the many changes that had taken place. As a teacher and friend, Dr. Ellis had been a guide in former times and after years of attainment he had been a leader in scientific developments within the Faculty. All the little personal touches coming as they did from one who knew them so well were fitting for such an occasion. While the attainments of Dr. Ellis have been great and varied in his scientific works, his labors have not been confined entirely to these fields. He has had many interests in life beyond his class rooms and for these he is known by those who perhaps never heard him lecture. Dr. Ellis not only taught men but he made men out of the students who came before him. Like all great teachers, a host of successful former students surround him in the business world in later life. He had built a noble edifice and the stones of it were the love and admiration of his students. On behalf of the graduates and undergraduate chemists of the Faculty, Prof. Bain then presented Dr. Ellis with a silver loving cup.

In replying, Dr. Ellis expressed his gratitude for the friendship which had beamed on him all evening. He said that his contact with the students of the school had been a pleasure which had increased year by year, and which culminated at the very moment. His students were scattered over the whole world but he would never forget their loyalty. During forty years he believed that he had stood before more students than any other Canadian Professor. He had lectured to Engineering, Arts, and Medical Students.

Dr. Ellis felt that there was a very warm spot in his heart for the old school. It was hard for him to adequately express his feelings, he said, and therefore he would simply thank them all from the bottom of his heart. His official capacity might change but his heart would always be with them and their work.

Telegrams and letters were read from Sir Robert Falconer, J. A. McK. Williams, W. L. Lawson, P. T. Kirwan, C. C. Forward, J. E. Breithaupt, D. R. Morrison and A. D. Dahl. A. R. Bonham, after thanking the graduates, presented Dr. Ellis with a bouquet of roses for Mrs. Ellis.

The final toast to the old boys was given by O. S. James, '91, who was the first graduate in chemistry from the school. His reminiscences were a revelation to those familiar only with the modern buildings. Mr. M. L. Davies of the Standard Chemical Co., pointed out how Dr. Ellis had become recognized as one of the architects of modern industrial chemistry. He had been an outstanding link between pure science and industry. Thus was passed with song, music, good fellowship and pleasant tales well told, an evening long to be remembered.

A New "Key" Chemical Industry for Canada

Plant of the Brunner Mond, Canada, at Amherstburg

The extensive new industries that are now growing up on the Ontario shore of the River St. Clair and Detroit River, between Lake Huron and Lake Erie, owe their existence, not solely to their advantages for shipping by water or rail, but to the fertility of the soil, and still more to their access to raw materials of prime importance to the key industries. This applies more particularly to such enterprises as the Brunner Mond, Canada, and the Canadian Steel Corporation, while among the older industries attracted by the same advantages, the works of the Canadian Salt Co. are a prominent type.

Among other works in the district now being built or in contemplation, not specifically connected with the chemical industries, are the Maxwell Motors Co., with a $1,000,000 Canadian branch; the Champion Spark Plug Co., $300,000; the Auto Specialty Co., $250,000; and the General Motors Corporation, who are prepared to establish a $6,000,000 plant. These are to be located at Windsor, Walkerville and Sandwich, which municipalities, with Amherstburg, will in the near future form a sort of metropolitan area, having a common policy of civic development. The works at the Steel Corporation site, to be known as Ojibway, near Sandwich, are this year advancing somewhat leisurely, the construction being confined to the erection of wharves and the laying of trunk sewers for the plant, which it has been stated will cost over $30,000,000.

The new enterprise of special interest to readers of this Journal is that of the Brunner Mond, Canada, Ltd., at Amherstburg, established to produce soda ash for the Canadian trade by the well-known Solvay system, devised by the celebrated Belgian chemists of that name, upon whose process over ninety per cent. of the soda ash production of the world is based.

When war severed the industrial connections of Germany with the rest of the world, there was an extensive and urgent demand in Great Britain, the United States, Canada and other countries. In order that Canada might be in a position to share in the world's alkali (soda ash) production, the Brunner Mond decided to erect for the Canadian market a plant which should represent the last word in this industry, and the result is the present immense plant, which will cost nearly $4,000,000.

Apart from the magnitude of these new works, the Brunner Mond, Canada, by this decision have given to Canada a key industry of national importance, for without the material here available, no well-rounded, native Canadian chemical industry could exist. It is a fact, not apparently recognized by some of our public men, that alkali stands second only to iron in the extent and variety of manufacturing processes in which it is essential. To name a few of their uses: The making of glass and soap requires soda ash as a principle ingredient, while paper making, chemical pulp, textiles, paints, the refining of oils, laundry work, leather making, paint and drug manufacturing, enamel ware, cleansing materials for domestic uses and manufacturing processes, including metallurgical work, are industries that would be crippled and some of them rendered helpless without it. These are sufficient to show how great a service has been rendered in consolidating the chemical and related industries of the country on a Canadian foundation. Another war or the severance of foreign trade would find the country self-sustaining in these necessary industries. If the owners of the Solvay process had withheld their supplies from the United States and Canada, all the industries named, and many more, would have collapsed.

General view, Works of Brunner Mond, Canada, Ltd.

The principal raw materials used in this process are salt, limestone and ammonia. The land for many miles in this district is underlain by an immense bed of rock salt, which will apparently serve for domestic salt and chemical production for centuries; and the other ingredient, limestone, is providentially at hand in immense beds. The company's supply of stone, which runs from 90 to 96 per cent. of calcium carbonate, will suffice for 150 or 200 years.

Plant Construction.

The construction of the plant occupied the years of 1916 and 1917, and every effort was made to get the plant completed, in order to supply Canada her requirements of soda ash, as the demand for this product was overtaxing the capacity of Great Britain and the United States.

The land holdings of the company, approximately five hundred acres, will allow for unlimited expansion, as

the industries of Canada demand increased output of this important chemical.

The main building at present put up occupies an area of 278 feet by 162 feet, built of steel and concrete, one portion of it being ten stories high or 176 feet from the main floor, the basement being under this. The boiler house covers an area of 160 feet by 60 feet, and is equipped with four 600 h.p. B. & W. type boilers, equipped with Taylor stokers, blast fans for which were supplied by the Canadian Sirocco Company; two of the boilers were built by Babcock & Wilcox Co., and two by the Goldie & McCulloch Company, of Galt, Ont., which company also supplied the largest battery of engines ever installed by a Canadian chemical firm. These engines consist of five Corliss engines of 175 to 200 h.p., connected to the vapor pumps, and five Wheelock engines of 25 to 31 h.p., operating the liquor pumps. The tubular boilers are of the three-drum type, and are built to stand a pressure of 200 lbs. per square inch.

The chimney for the boilers is 200 feet in height, and was built by the Canadian Kellogg Company.

The steel work of all buildings was supplied by the Canadian Bridge Company, of Walkerville, who furnished about 4,000 tons of fabricated steel, erecting the same as required to keep in step with the installation of other equipment. The steel concrete material was furnished by the Trussed Concrete Steel Co., of Walkerville, Ont.

All material for the buildings and equipment that could be obtained in Canada was purchased from Canadian manufacturers, the large bulk of the castings being supplied by Canadian Allis-Chalmers and the Canada Iron Foundries.

The Foundation Company, of Montreal, contracted for the 5-ft. main sewer, built from reinforced concrete tile, supplied by Brennan & Hollingworth, of Hamilton. This sewer consists of 1,500 ft. of 5-ft. tile and 400 ft. of 4-ft. laterals.

The pump house for the supply of water contains three 2,000,000-gallon, motor-driven, centrifugal pumps for the plant supply, and seven pumps for the domestic supply for the town of Amherstburg.

In this conection, the company has built a most modern purification and filtration plant of sufficient capacity to supply the domestic water used by the town of Amherstburg, as well as for the company's own requirements. The present capacity is 2,000,000 gallons of filtered water per day, for the town, besides an abundant supply for the works.

The coal used in the plant is all handled mechanically, being received in bottom dump cars and conveyed by inclined belts, supplied by the Canadian Link Belt Company, to bunkers above the boilers. The electric generating plant consists of two 600-k.w. and one 300-k.w., 3-phase, 60-cycle, 480v-olt turbo generators, with two 25-k.w. steam turbine-driven exciters. The electrical and switchboard equipment was furnished by the General Electric and the Northern Electric Company. The switchboard gallery is 12 ft. by 72 ft. in length, the floor of which is 8 ft. above the engine-room floor, the cable room is underneath and in the basement.

All the machinery, with the exception of the prime movers, is motor driven, either by silent chains or belts.

The works have an up-to-date larobatory, with apparatus for testing the materials used. In this laboratory is installed a combination gas machine, from the Detroit Heating and Lighting Co. This machine is used for various heating purposes in the laboratory, such as the operation of blow-pipes, Bunsen burners and blast burners, and also for boiling liquids. These appliances are found very serviceable in laboratory work for isolated plants, as they give a uniformity of result, better in many cases than from city gas. This machine automatically makes the gas as fast as used, no heat being required to generate the gas. It is made ready for instant use by turning the cock and applying the match, and the cost compares favorably with public gas.

The quarries from which the limestone used in the soda ash manufacture is obtained are situated less than a mile east of the main plant, and are connected therewith by a line of standard-gauge railway. The kiln in which the stone is burnt is the largest and most up-to-date in America, being 70 feet high, with an inside diameter of 14 feet. The mixing of the coke and stone is mechanically handled by means of a skip bridge from the mixing hopper to the top of the lime kiln, the burnt lime being next handled by an elevator on the bottom of the lime kiln to the slacking rotaries. The carbon dioxide gas is conveyed from the kiln through a 36-inch main to the compressors. The stone-crushing plant has a capacity of 1,000 tons a day, and the stone is handled by an eighty-ton shovel.

The salt deposits are situated in Lots Nos. 29 and 30 of the First Concession of Anderdon, three miles north of the main plant, comprising an area of 95 acres, under which area a bed of rock salt 200 ft. in thickness and 800 ft. below the surface, gives unlimited supply of the necessary sodium chloride. This salt is reached by means of wells drilled from the surface to the salt depth. In these wells are two concentric pipes, in the outer and around the inner, the water is pumped to the deposit, which water dissolves the salt and is forced through the inner pipe to the surface, whence it is pumped through an 8-in. C.I. line to the main plant.

Outline of Process.

The manufacture may be outlined as follows: The brine received from the wells is charged with ammonia gas in the absorbing apparatus. This ammoniated brine is then pumped to precipitating towers and there subjected to contact with the carbon dioxide gas from the kilns, pumped by means of compressors into these precipitating towers.

The chemical action takes place as follows: $NH_3 + NaCl + H_2O + CO_2 = NaHCO_3 + NH_4Cl$. These latter two chemicals flow to the filters and are separated, the $NaHCO_3$ going to the furnaces and the NH_4CL to the distillation tower.

In the furnaces the calcination of the bicarbonate is as follows: $2NaHCO_3 = Na_2CO_3 + CO_2 + H_2O$, the CO_2 returning to the compressors and the Na_2CO_3, which is the soda ash, going to the shipping room.

The ammonium chloride, or NH_4Cl, is pumped to the distillation tower, where it comes in contact with the lime, this lime having been slacked in the rotaries. The chemical action being as follows: $2\ NH_4\ Cl + (Ca)OH_2 = CaCl_2 + 2\ NH_3 + 2H_2O$, the NH_3 passing to the absorbing apparatus and used over and over again, the $CaCl_2$ going to the by-product plant for the manufacture of calcium chloride.

The works have a capacity of 112 to 130 tons per day of soda ash.

Transportation for the finished product is by means of the Essex Terminal Railway, a standard-gauge line, connecting with all the trunk lines of Canada at Walkerville and Windsor, and the Michigan Central Railway, connecting with the main line thereof at Essex, and water transportation to the upper lakes by means of the Detroit River.

The officers of the company are: Mr. E. N. Trump, President, Syracuse, N.Y.; Sir Edmund Walker, Vice-president,

Toronto, Ont.; A. H. Green, Vice-president, Detroit; Wallace Campbell, Secretary, Syracuse, N.Y.; G. S. Rutherford, Manager, Amherstburg, and A. L. Campbell, Asst. Manager, Amherstburg.

Mr. Rutherford is a resident of Amherstburg, and has just been elected president of the Board of Trade of that town.

The Present Situation.

Seven hundred men were employed in the construction of this plant, but now that it is finished, it will seem strange that only about a hundred men are at work for the purpose of keeping the machinery in order. Soda ash and its related compounds are not yet being produced, and the explanation is that the company has so far been left "in the air" as regards the conditions on which the Canadian market is to be supplied. On the other side of the river, a Solway process plant is in operation supplying the American market south, as well as west. The consumption of soda ash in the United States is normally about a milion tons a year, whereas the normal consumption in Canada before the war was about 30,000 tons a year. This grew to 40,000 tons in Canada last year, but this was due to war requirements, and it was to secure production in Canada for war purposes that this large plant was built. Now that the plant has been erected at enormous cost to fulfill a national function, and just as it is ready for operation, the market is thrown open without apparent restriction and at prices below normal costs of production. The American market, however, is protected by prohibitions and restrictions of imports. The company regard this situation as involving a great injustice to the Canadian industry, which is subject to a further handicap by the necessity of paying duty on the coal and coke required. The U.S. manufacturers not only have the advantage of cheaper coal and coke, but cheaper ammonia. The discrimination in the price of coal amounts to $1.65 a ton and on coke $2 a ton.

If conditions were equalized, the works could produce, besides caustic soda (soda ash), satin white, used in the manufacture of coated paper, calcium chloride, used as a road binder; bicarbonate of soda, sal soda and washing compounds, as well as large quantities of land lime, which is shipped to the west and south from the Solvay Works on the Michigan side of the river; and like quantities of which could be available for Canadian agricultural purposes from the Amherstburg plant.

The Brunner Mond works and those of the Canadian Salt Co., referred to in another article, are cases involving the industrial safety of the country, apart from the justice of the claim that such key industries should be safeguarded in the critical time of readjustment following the war.

CHEMICAL SOCIETY NEWS

Montreal Branch.—On April 25th, at the Canada Club, the final meeting of the season was held. Following the dinner, annual business was taken up and arrangements made for the Convention. Mr. T. H. Wardleworth, of the National Drug Co., was the guest of honor, and received a very warm welcome, indeed. He has been one of the main supporters and leaders in the Montreal Branch for some time. He spoke in review of the work he had been connected with during the war. His subject was "The Stopping of a Great Machine." Difficulties that had been overcome in handling enormous quantities of raw materials under stress of war-time commerce were pointed out. A fine tribute was paid to the actual heroism of those chemists and workers who had operated the T.N.T. plants at various places in the Dominion. The danger was continual and the nerve strain very great. Credit is due to these men that so few lives were lost in this way, and the detailed story of the Trenton explosion is something that all those who can appreciate must marvel at the way in which the men remained on duty at their stills doing everything possible to prevent the calamity. A resolution was passed, asking the Government to continue the sale of oleomargarine in Canada. During the year ten associate and twelve full members had been added to the Montreal Branch. Mr. Roast stated that he had on his list some 699 names of Canadian chemists. For the coming year, the following gentlemen were elected: Chairman, R. Job; Secretary, G. D. McIntyre; Committee, T. Grageroff, P. H. Holland, Dr. R. McLean, C. R. Hazen.

Ottawa Branch.—The teaching of chemistry, from the viewpoint of the manufacturer, was the subject of a very excellent address, delivered before this Society by Mr. F. J. Hambly, F.I.C., of the Electric Reduction Co., of Buckingham. The meeting was well attended, and the members evinced keen interest in the subject discussed. In the course of his remarks, Mr. Hambly made reference to the small amount of science taught in our primary and secondary schools, and pointed out that until more science was taught in these grades, the average citizen of the country who does not go farther than our secondary school for his education is unable to appreciate the value of science, either as a subject of training or as a means of national development. He outlined for the benefit of the members present a number of plans in vogue in Great Britain and the United States and developed this phase of his subject at some length. The question of the value of the newly graduated chemist when he enters the works was handled from the manufacturer's viewpoint, and this point of view was shown to be somewhat different from the conception the graduate himself has as to his importance. The speaker deplored the fact that many chemists, as they are made to-day, failed to grasp the importance of the economy of a plant, and were consequently not willing in many cases to devote the time and energy essential to obtaining a thorough grasp of the practical operations in the factory.

Mr. Hambly has been a works chemist, and a manufacturer and he was consequently able to bring to this subject a wealth of practical information, which made his address very interesting.

The next meeting of the Society in Ottawa will be completely given over to the discussion of the proposal received from the Chemists' Organization Committee and the members hope at this meeting to arrive at some definite conclusions in order that the representatives who attend the Convention in Montreal may be able to guide their actions in accordance with the expressed desires of the Ottawa chemists.

Toronto Branch.—The last meeting for the season was held as usual as a dinner gathering in the Engineers' Club. The guest of the evening was Dr. A. J. Harker, who is spending a short time in Canada following his connection at Washington. Dr. Harker was a director of research for the Munitions Inventions Department, London. The speaker outlined the work on nitrogen production which has been his special care during the war.

In a short time a rapid survey of the situation that had been met was presented. Some of the more recent changes in conception were pointed out. In England, the authorities were preparing to produce nitrogen by the arc process, using coal to generate electric power and also the Haber process, if necessary. The new efficiency that was obtainable in a steam plant where the current generated was used on a full electro-chemical load, made it feasible to consider this source of nitrogen in England. The Haber process was put upon a semi-commercial scale, but served chiefly as a model for investigators and was an assurance that the method could be used if ever thought advisable. In France, the cyanamid method developed as the most practical way for them. In the United States both the Haber and cyanamid processes were pushed forward but production was delayed so that the new plants were just coming into use as the armistice was signed. The Haber process was the main support of Germany. They had technical production started in 1914.

In the matter of using ammonium nitrate in shells a revolution had taken place. At the close of the war the ratio of T.N.T. to ammonium nitrate was 20 to 80, while at the beginning it was 60 to 40. Other nitrogen compounds were not available and it was very necessary to find some method of using larger quantities of ammonium nitrate.

It was shown that the use of ammonium sulphate as a fertilizer had greatly increased in England during the war. Production was essential and now the consumption of ammonium nitrate is 4½ times what it was in 1914—or is over 200,000 tons.

Following this address it was pointed out by Prof. J. W. Bain that with electric power on the St. Lawrence at $10 per horse-power-year and soda ash at $15 per ton we could make nitrate of soda at tide water cheaper than it could be brought to America from Chili.

Mr. M. L. Davies, who has just returned from a business trip to France and Germany, reported a most interesting visit. The Standard Chemical Company, which he represents, had a plant in Germany at Worms and a second in France. The French plant was completely destroyed, while the German plant had been worked to the limit and not a few changes in machinery had been made. Mr. Davies clearly pointed out that there were enormous difficulties in the way of rapid reconstruction in the devastated areas. Everything needs to be done at once. It is evident that the finer arts and industries cannot be placed on their feet again for some time. One of the chief difficulties ahead of rapid English production was the necessarily slow way in which certain key men were returned to civil life.

A committee consisting of eight full members and one associate member was elected for the coming year. From this committee, officers for the year will be chosen. The following were elected: Prof. E. G. R. Ardagh, L. T. Acton, Prof. J. W. Bain, M. L. Davies, H. van der Linde, D. G. Buchanan, H. E. Rothwell, L. E. Westman and C. F. Thurlow (associate representative).

PERSONAL

Dr. John S. Bates, who for several years has been superintendent of the Dominion Government Forest Products Laboratories in Montreal, has resigned to take a position with Price Bros. & Co., of Quebec. Dr. Bates was chairman of the Technical Section of the Canadian Pulp & Paper Association and was a very active member of the Society of Chemical Industry. His work has been of much importance to the Advisory Research Council and the Imperial Munitions Board. He is the author of a number of papers and his practical work during the war was of great value to some of the electro-chemical industries at Shawinigan Falls. While the public service of the Dominion has lost one of its brighest technical men, the business organization to which Dr. Bates has gone is to be congratulated.

It is estimated that the Departments of Chemistry and Applied Chemistry at the University of Toronto, furnished over eighty trained chemists for war work.

The executive committee of the Toronto Branch of the Engineering Institute of Canada has appointed three sub-committees. The first is to consider the ways and means of finding employment for disengaged engineers and for the advancement of others who are seeking the same. This committee has elected Mr. E. T. Wilkie as chairman, and Mr. W. Cross as secretary.

The second sub-committee was appointed to consider the feasibility of drafting a scale of fees for service rendered by engineers. This committee is presided over by Mr. Frank Barber and the secretary is Mr. W. S. Harvey. The third committee is considering the problem of grading the salaries of engineers according to their responsibilities and duties of office.

It is expected that Dr. J. C. McLennan, who has accomplished such valuable work, in connection with the British Admiralty will return to Canada shortly for a few months' visit.

Mr. R. R. Carr-Harris has succeeded Mr. John B. Paine as President of the John B. Paine Co., Ltd. Mr. Paine has retired owing to ill-health.

Professor J. Watson Bain, who has done such valuable work for the Canadian War Mission, Washington, D.C., has returned to his duties at Toronto University.

Mr. C. O. Stillman has been elected President of the Imperial Oil Company in succession to the late Hon. W. J. Hanna. Mr. Stillman has been Vice-President since 1911, and prior to that date was superintendent of the Bushnell Company, Limited, which preceded the Imperial. Mr. A. M. McQueen, who has had charge of the extensive development program of the company in the West since 1916, succeeds Mr. Stillman as Vice-President.

The Dominion Steel Corporation, Sydney, C.B., has added an economy engineer to their staff in the person of Mr. F. E. Lucas. His department will investigate with the view of eliminating wasteful practices in the various sections of the plant.

INDUSTRIAL SECTION

British Columbia.

Vancouver.—The Tudhope Electric Metal Company, Ltd., which is erecting a plant on the C.P.R. reserve on the north shore of False Creek, will instal a large electric furnace, utilizing large quantities of scrap metal. All the old scrap metal, borings and broken castings of the C.P.R. have been contracted for, and will be melted up and cast into pig iron.

A new industry which will supply both local and export markets is now being completed on Industrial Island, and will be known as the Pacific Roofing Company, Ltd. The chief product of the plant will be asphalt roofing, in rolls, and asphalt compounds.

Vancouver.—Gold mining interests are again actively engaged in the Yukon and Klondike River Districts; they are preparing for extensive dredging and hydraulic work. In spite of the heavy handicaps, due to the war and other causes, the Klondike district produced, last year, about two million dollars in gold.

A new strike of gold has been made on the Yukon River, forty-five miles above Marshall City. These diggings are showing good values and large areas have been staked around the first locations.

The mining properties now being worked in the Salmon River District are the Premier, Mineral Hill, Joker, the Big Missouri, recently bonded by Sir Donald Mann, the Yellowstone, Bush mines, Forty-Nine and Silver Creek. Several important mining deals have taken place lately in this district, no doubt the recent Mining Convention has had much to do with the encouragement of these transactions.

The Provincial Government of British Columbia intends to establish immediately an iron and steel smelting industry near Vancouver, by putting into operation the provisions of the "Iron Ore Supply Act." The Vancouver Magnetite Iron and Steel Smelting Co., Ltd., has a smelter at Potlatch Creek, Howe Sound, near Vancouver, which has, up to the present, only been used for demonstration purposes. This plant expects to start working on ore shipments this month as the Minister of Mines has decided to ship immediately 5,000 tons of magnetite ore free of charge to this company's smelter.

The largest manganese bronze casting ever made in Canada was run, recently, at the Wallace foundry on Granville Island. The weight of this casting is 9½ tons and is the propeller of the first Canadian Government Steamer to be built on the Pacific Coast.

An appropriation of $50,000 is being granted to the Provincial Minister of Mines "to aid in the development of coal, petroleum and natural gas lying under crown lands." It is intended that this vote of money shall be used to investigate the oil prospects near the Alberta-British Columbia boundary. Oil, no doubt, exists in several other localities in British Columbia although no deposit of an economical value has yet been proven.

A new industry is to be started on Vancouver Island in the manufacture of calcium carbide for export to Australia, New Zealand and Asia. The probable situation of this plant will be Union Bay, where cheap hydro-electric power can be obtained from the Puntledge River plant of the Canadian Collieries (Dunsmuir), Limited. Coke and high grade limestones are available in the vicinity for use in this industry.

The announcement that the Alaska Sulphur Company will open its mines on Akun Island, one of the Aleutian Group, is of a special interest and great importance to the British Columbia pulp industry. The prohibitive price of Japanese sulphur has forced the local pulp and paper interests to bring in Texas sulphur. This product, although more expensive is claimed to be much purer than that obtained from Japan.

The Canadian Carbonate Company, of Montreal, has decided to erect in Vancouver, a factory for the production of carbonic acid gas. The initial expenditure will be approximately $70,000 for the construction of the plant and installing the necessary equipment.

Experimental work is now being conducted in Vancouver, on the production of electrolytic copper from crude ore by the newly discovered Lockwood-Dalziel process. It is claimed that this process is both simple and inexpensive, and hopes are maintained that soon both the small and large operators will be able to treat their ores more economically than hitherto.

Anyox.—The reopening of the big copper smelting plant, owned by the Granby Consolidated Mining, Smelting and Power Co., at Anyox, B.C., coupled with strengthening of prices on the copper market, during the past month, has put British Columbia into line again with the large copper producers of this continent.

Trail.—The Consolidated Mining and Smelting Co., Ltd., which owns and operates the Trail Smelter, has recently made an issue of $3,000,000 of bonds, all of which have been applied for by the present shareholders. The directors have decided, however, to give preference to employees in the allotment of these bonds. The recent advancs in metallurgy, especially in the treatment of low grade ores, will assist this company to convert many of their hitherto unprofitable holdings into paying mining ventures.

Copper Mountain.—The Canada Copper Corporation has resumed work at their mine at Copper Mountain. This concern is now installing heavy machinery at the mine in order to supply their new mill at Alleby with ore.

Manitoba.

Winnipeg.—Winnipeg is thinking of controlling the milk supply of the city and undertaking the entire distribution. Negotiations with the different milk companies are now under way.

Nova Scotia.

Springhill.—The Dominion Coal Co., Ltd., Glace Bay, contemplate the erection of a compressor plant. Estimated cost, $200,000.

Ontario.

Galt.—Plans are being prepared for the erection of a new silk mill for McCormick and McCormick.

Guelph.—At a meeting of the directors of the International Malleable Iron Co., last month, it was decided to proceed at once with the erection of a new factory, three stories high, 160 by 60 feet. The new building will be used for the

manufacture of pipe-fittings for the foreign and domestic trade, and will provide employment for at least 100 men to start with.

The ratepayers voted last month on a by-law granting exemption from taxes and a $50,000 loan to the Partridge Rubber Footwear Co. The factory will cost $250,000, and give employment to 500 people.

The Premier Rubber Co. will erect a four-story reinforced concrete factory building. Estimated cost, $125,000, and also a concrete rubber shoe factory, costing $150,000.

Port Colborne.—The Canada Cement Company, at Port Colborne, are preparing to erect a potash recovery plant, in connection with their Port Colborne works, using the spray method.

Port Hope.—The Canadian Mathews Gravity Carrier Co., Ltd., have purchased a new factory in Port Hope and have moved their general office and factory there. A branch office is still maintained at 407 Lumsden Building, Toronto.

Sarnia.—Romeo Foundry Co., Port Huron Mich., plans erection of foundry. Manager, L. G. Blunt.

W. D. Ferguson and J. McCutcheon have purchased the building at 313 Front St., known as the Woolen Mills Building, and will spend between $40,000 and $50,000 renovating it for a cold storage plant.

The H. H. Robertson Co., of Canada, capitalized at $200,000, has been incorporated for the manufacture of asbestos-covered steel roofing and siding, ventilators, gutter and drain pipes, skylights and asphalt paint. The new company has purchased the plant of the Sarnia Metal Products Co., and will commence operations May 1st. Approximately $25,000 worth of new machinery will be installed and employment given to about forty hands at the start.

Toronto.—West Toronto may possibly be chosen as the site for construction of packing houses by Armour & Co., Chicago, and the Matthews-Blackwell, Ltd. Total estimated cost, $6,000,000.

A permit has been granted W. Harris & Company for the erection of a glue factory, four stories high, costing $148,788. The building is to be of brick and reinforced concrete, 145 by 66 feet, and is to be erected on Keating Street, near Cherry.

The plant of the Canada Wire and Cable Company, Dundas Street, was almost completely destroyed by fire, April 27th. Loss estimated $200,000. The plant was shortly to be moved to new buildings at Leaside.

The Neptune Meter Company, of New York, are establishing a branch here with Mr. Wm. H. Randall, formerly of the Toronto Waterworks System, in charge. The company will locate in a section of the Russell Motor factory, King and Dufferin Streets.

The Marvel Lubricant Company, Mail Building, Toronto, are expanding their manufacturing operations. They will specialize in the manufacture of greases and lubricants for heavy machinery and use. During the last few months, they have developed some novel and handy cans for special purposes.

Gunns, Ltd., have commenced construction of a new cold storage plant at an estimated cost of $500,000.

A permit has been granted Toronto Steel Construction Co., for a one-story steel and galvanized iron mill building, 60 by 144 feet, to cost $20,000. The product of the factory will be steel for use in the construction of high office buildings.

Sudbury.—This year's output of the Sudbury Co-operative Creamery has all been contracted for by a Toronto abattoir. Last year this creamery, which was assisted in its establishment by the Government, produced 161,867 pounds up to Nov. 1st, 1918.

Welland.—Dillon Crucible Alloys, Limited, which recently began operations in Welland, having purchased the Quality Beds property, and having erected a number of new buildings, is now employing fifty men and turning out two tons of high speed and carbon steel every day.

The Nicu Steel Corporation, Limited, has been organized, with offices in Toronto and New York. The plant will be located at Welland. It will smelt ore to produce iron, nickel, and copper.

Windsor—The municipality are considering the establishment of a modern municipal dairy plant. Estimated cost, $20,000.

Wyoming.—Nicholson & Sons, of Oil Springs, have purchased site and are planning to erect a flax mill, which they hope to operate this season. The machinery of the mill will be run by hydro power.

Libby, McNeil & Libby, pickle manufacturers, have secured a site in the village and will erect a salting station in the near future.

Quebec.

Three Rivers.—The Tidewater Shipbuilders, Ltd., are entering business as manufacturers of marine boilers and engines and have erected a plant costing around $500,000.

Foreign.

Portugal.—According to Kelly's Monthly Trade Review (London), there is a considerable demand for chemicals, and glassware at St. Michaels. A new industry has been revived here, that of the cultivation of sweet potatoes for alcohol distilling. For this purpose an association has been formed by prominent farmers to enable members to purchase machinery and tools. The establishment of a regular line of steamers between these Islands and America is under consideration.

Sweden.—A new factory has been erected at Ulvsunda for the manufacture of chemicals. Several other chemical factories, it is said, are planned for erection in other places in Sweden.

Japan—Yokohama—Since the armistice was signed, prices of chemicals have dropped enormously here. Considerable quantities for shipment to America were left on the hands of the shippers. Especially is this true of soda ash and bi-carbonate of soda. Potash, mercury, and carbolic acid have also dropped in price.

NEW YORK TRADE NEWS

By F. M. Turner, Jr.

April 26th, 1919.

The Heyden Chemical Works, Garfield, N.J., was sold by the Alien Property Custodian on March 27th to A. F. Ryan, a New York financier, and son of Thos. F. Ryan, a well-known millionaire, for $1,500,000. The property was previously offered for sale on February 14th, but the highest bid received at that time was judged inadequate by the Alien Property Custodian. Mr. Ryan's offer was over $1,000,000 more than the highest bid at the previous auction.

Other bidders were the American Aniline Products, Inc., whose plant at Nyack, N.Y., recently was destroyed by explosion and fire; E. I. DuPont de Nemours & Co., Wilmington, Del.; Karpen Brothers, Chicago; Monsanto Chemical Works, St. Louis, Mo.; Truslow & Fulle; and McKesson & Robbins, New York, one of the oldest and largest manufacturers and dealers in pharmaceuticals in the city.

The Heyden Company is a New Jersey corporation, originally a branch of the Chemische Fabrik von Heyden, of Germany. A large line of pharmaceutical and other chemicals have been manufactured from formulae supplied by the chemists of the original concern in Germany, some of whom came over to supervise the starting of the plant. Salicylic acid, salicylates, aspirin, saccharin, formaldehyde, etc., have been among the principal products. Since the plant was seized by the Government, it has been operated under the direction of Dr. J. A. Brannegan, the well-known Philadelphia chemist, who was appointed to run it by the Alien Property Custodian.

Some curiosity exists as to whom Ryan purchases such a large chemical plant for, since it does not seem to fit into his other activities at all, he being chiefly interested in the Stutz Motor Car Co., and the Royal Typewriter Company, of both of which concerns he is president.

Americanizing Chemical Plants.

A large block of the stock of Merck & Co., Park Place, New York, has been offered for sale by the Alien Property Custodian. When this block of stock is acquired by American citizens, the entire company will be owned in America. Merck & Co. are celebrated for their reagents, which have long been accepted as a standard of purity, and are also large manufacturers of pharmaceutical and photographic chemicals, and also large tar distillers. Their principal plant is at Rahway, N.J.

Another well-known concern undergoing a process of complete Americanization is the General Ceramics Company, New York, one of the largest manufacturers of chemical stoneware in the world. This company has been completely American in spirit and management, having changed its name from German-American Stoneware Works to General Ceramics Company at the beginning of the war, and having co-operated with the Government heartily in supplying important items for explosive and poison gas plants. However, a certain block of stock has been held in Germany, and this is now to pass into the hands of Americans.

Chief Chemist's New Post.

Dr. T. B. Wagner, of the Corn Products Refining Company, has severed his connection as chief chemist with that company to take a similar position with the United States Food Products Corporation, recently formed by the Distillers Securities Corporation.

The business of the American Spray Company, manufacturers of spray nozzles and designers of cooling systems, humidifying equipment, etc., has been acquired by E. B. Badger & Sons Co., Boston, Mass., the well-known designers and builders of chemical machinery. It will be operated under their name as the American Spray Department.

Sulphuric Acid Situation.

Leading sulphuric acid makers of the United States met at the Waldorf, New York, on April 2nd, and discussed the effect on the industry of the Government unloading its stocks of sulphuric, nitric and other acids. It developed at the meeting that the Government was only holding about 9,000 tons of all kinds of heavy acids. Since the annual pre-war consumption was about 4,000,000 tons, little was feared from the offering of the Government's stock to the public. However, it is possible the Government will have to take over much larger amounts from various contractors, which will possibly be a more serious factor. W. D. Huntingdon, of the Davison Chemical Co., Curtis Bay, Baltimore, Md., was in charge of the meeting.

Mr. A. E. Marshall, works manager of the Davison Chemical Company, Curtis Bay, Baltimore, Md., and formerly manager of the United States branch of the Thermal Syndicate, Ltd., Newcastle, Eng., is leaving for England, May 1st, on a business trip of several months' duration.

German Patents Sold.

According to a communication from the Alien Property Custodian to the Bureau of Foreign and Domestic Commerce, "All of the German dye and chemical patents (including allied subjects, such as metallurgy, fertilizers, fixation of nitrogen, hydrogenation of oils, etc.) have been seized by the Alien Property Custodian and sold to the Chemical Foundation. The Chemical Foundation will use the patents to prevent interference with the American industries, to which they relate, by Germans after the war, by issuing non-exclusive licenses to American manufacturers, and will also institute suits for infringement based upon the importation of goods of German manufacture." This is a most important step, as it practically renders impossible the restoration of the prosperity of German trade agencies in this country after peace has been settled. The Chemical Foundation is a corporation, composed of important men in the chemical industries, which will act as a holding corporation for the patents seized by the Government.

The Organic Salt & Acid Company, Long Island City, N.Y., makers of various fine organic chemicals, have bought the plant of the Maas & Walstein Company, at Avenue R., Newark, N.J. This plant was used during the war for making nitro-cellulose, etc. The Maas & Walstein Company will continue their usual business of making lacquers, etc., at their other plant.

The potash producers of America have organized an association to urge suitable tariff protection for the potash industry, which has grown up since the war began. The meeting took place at Denver, Col., and the association will be called the National Potash Association.

The Chromos Chemical Company, New York, manufacturers of colors, with offices in Aeolian Hall, and a plant in Brooklyn, has been seized by the Alien Property Custodian. The company was owned entirely by enemy aliens, and the president, I. Strauss, is in prison as a dangerous enemy.

Mr. E. Coley, Secretary of the newly-formed Chemical Industries Club, London, Eng., has recently been spending some time in New York City, during which time he has been a frequent visitor at the Chemists' Club. The new club in London deprives the Chemists' Club, New York, of the distinction of being the only complete social club exclusively for chemists in the world. The loss of this distinction will, however, be more than made up for by the pleasure in the fact that the chemists of London are to enjoy similar facilities and opportunities for meeting. A reciprocal arrangement giving the privileges of each club to members of the other when in England and America respectively has been arranged.

Mr. L. V. Redman (Trinity College, University of Toronto, '08) has been spending some time in New York recently in connection with some patent litigation in which his company, the Redmanol Products Co., Chicago, Ill., is involved.

The Industrial Bill passed this session by the British Columbia Legislature provides for a new Department of Industries which will have a wide scope of activity. The powers of the Department will be: to provide for industrial research, to acquire and utilize existent knowledge in arts and manufacturers, to carry out an economic survey of natural resources, to furnish advice regarding industrial problems, to publish technical, scientific and statistical information and generally to promote the economic development of the province.

MEETINGS OF MONTREAL ENGINEERS.

Another Somerville lecture was given by Dr. J. S. Bates, on "Developments in the Canadian Chemical Industry," during the war.

At a recent meeting of the Electrical Association, Mr. G. Percy Cole, Technical Engineer of the Dominion Glass Company read a paper on "Electricity in the Glass Bottle Industry."

At a recent meeting of the Montreal Branch of the Engineering Institute of Canada, a paper was read by Mr. J. A. DeCew, on Waterproof Paper Productions and Their Industrial Possibilities. References were made by the speaker to the possibilities of a papercloth industry and to the great developments in the use of paper products, as substitutes for wooden products.

Mr. DeCew instanced paper boxes, candy pails and barrels, the last named being the latest development along these lines. A number of experiments, he said had been made with a view to making paper products moisture-proof, but there had been practically no success.

A great deal of attention had lately been paid to paper wall board for interior decoration. It had also been used in place of lumber for concrete forms. Owing to the diminishing quantity of clear long lumber, Mr. DeCew said, there was an opportunity to make greater use of boards of paper made up of the waste wood products. The whole problem, however, was bound up with the ability to make these products waterproof, or nearly waterproof.

Answering questions as to the possibilities of paper clothing, the speaker stated that paper clothing had been worn not only in Germany, but in France, the Government paying 19c a yard for specially prepared paper. Paper cloth was quite feasible if a paper cotton could be devised which was waterproof, and he believed that an industry would eventually be established, just in the same way as we had artificial silk. It was really a question of providing the proper machinery to produce a cloth which would be waterproof, and which could be used commercially.

In a talk before the Montreal Branch of the Engineering Institute of Canada, Mr. Paul A. Seurot spoke on the use of Coal Briquettes. In the course of his address he was able to show that Canada was losing a great opportunity for conserving her coal resources. The observations of Mr. Seurot were based on experiments made in France and the U.S., and on visits to French briquetting plants. He stated that Canada was wasting an enormous amount of coal by neglecting to briquet the slack at the mines and the run-of-mine dust. This country was dependent on the U.S. for much of her coal supply, and this coal could be in part supplied by briquetting the slack.

Of the total coal brought to the surface, 10 to 35 per cent. was waste. Some briquetting plants were in operation in the West, turning out 1,100 tons per day, but these used only a comparatively small amount of the waste coal. In Germany, 20 million tons of briquetting were made, and in France, immense quantities were also manufactured.

With a view to securing data, Mr. Seurot wrote to Montreal coal dealers as to the amount of their screenings. The result, he said, was disappointing. Many did not answer; others stated that they gave the screenings away, and one dealer in replying said he was aware that the information was required in connection with briquetting, and he was not willing to give particulars which would interfere with the coal dealers' rights.

Mr. Seurot stated that there was a certain amount of prejudice against briquettes, but experience had shown, he said, that their use did not interfere with the ordinary coal trade. He enumerated many advantages of briquettes as an economic fuel for several purposes.

Mr. R. de L. French, read a paper on "The Design and Construction of Reinforced Concrete-Covered Reservoirs," and showed a number of unique views of designs and construction.

POSSIBILITIES OF ESTABLISHING A POTASH INDUSTRY IN ENGLAND.

The presence of potash in the dust from blast furnaces was known as far back as 1878, and systematic efforts have been made to recover it. By suitable treatment and operation, as much as 30 kg. of potassium carbonate can be recovered per 10,000 cubic metres of gas. This is obtained by dry purification of the gas and votalisation of the alkali as chloride by the addition of sodium chloride. The proportion of potash to soda volatilised as chlorides is fairly constant, varying from 85:15 to 90:10. By this process, potassium chloride may be produced at a lower price than the German potash delivered in England before the war. The blast furnaces at present in operation could supply 400-500 tons of KCl a week, and could also supply the most pressing needs of the country for 99 per cent. potassium carbonate, 90.5 per cent. potassium bicarbonate, 99.8 per cent. potassium ferrocyanide, and 99.8 per cent. potassium permanganate.

Other sources of potash are the dust from cement kilns, and wool-grease. Research is being carried on along both these lines, but the cost of recovery from cement kilns is higher than that from blast furnaces.

During the discussion which followed the reading of the paper, it was said that the Ashcroft process, which consists in heating to a high temperature potash-bearing rocks in the presence of sodium chloride, gave yields up to 85 per cent. of the potash present, and the cost of production before the war was lower than the price of German potash.—K. M. Chance, in J. Soc. Chem. Ind., XXXVII., No. 14, July, 1918, through Chimie & Industrie, II., No. 2, Feb., 1919.

LINK BELT CO., OPENS MONTREAL BRANCH.

The ever increasing demand for Link-Belt throughout the Dominion and the desire to render customers in the Eastern section a service in keeping with the high standard of Link-Belt Chain, the manufacturers have opened a branch at 1195 St. James St., Montreal.

A liberal stock of popular types of Link-Belt will be carried in stock at Montreal in the future, from which all orders in that section will be promptly filled.

The expansion of this company in Canada is evidence of the good work they have been doing for a number of industries during the war period.

For the present, the Montreal branch will serve largely as a warehouse, all engineering assistance being rendered by the Canadian Link-Belt Company at Toronto, where Link-Belt is manufactured for the Canadian market.

Although shipments for the Montreal and Quebec territory will be shipped from the Montreal branch, the executive offices will remain at Toronto.

PAPER FROM BAGASSE.

A paper mill, with a daily capacity of 165 tons, is being erected at Olaa (Hawaii) for the manufacture of all kinds of paper. This production will utilize only one-tenth of the available supplies of bagasse of the sugar factories of Olaa. The mill has been planned with a view to being gradually expanded, so as to ultimately utilize all the available supplies of bagasse, should the venture prove successful, in which case the output could reach 165 tons a day, and even more, should the factories in the other islands follow this good example. The mill cannot start for another year, as the required machinery could not be obtained during the war.—Chimie & Industrie, II., No. 2, Feb., 1919.

SYNTHETIC ALCOHOL IN GERMANY AND SWITZERLAND.

This industry has greatly expanded in Germany during the war to supply alcohol for fuel, and has largely supplanted alcohol obtained from potatoes.

One hundred and fifteen thousand tons of alcohol are obtained as a by-product in the manufacture of celluloid (287,000 tons), and 178,000 tons are obtained from sawdust. But the largest amount of synthetic alcohol is obtained from calcium carbide. This process is also largely used in Switzerland, where, moreover, the acetaldehyde is also oxidised to acetic acid.—Chimie & Industrie, II., No. 2, Feb., 1919.

RESOLUTION OF A WESTERN BOARD OF TRADE.

That Western Canada is becoming alive to its best interests along non-agricultural as well as farming industries is illustrated by the following resolution recently passed by the Saskatoon Board of Trade:—

Whereas Canada imports 95 per cent. of her iron ore; 98 per cent. of her petrolea products; 50 per cent. of coal and large quantities of other raw materials, and

Whereas such raw materials are available in Canada, and

Whereas these resources not only contain the materials for basic national industries, but are also an unlimited source of wealth for the payment of Canada's national debt.

Whereas we believe that British capital can be induced to develop such resources for the benefit of the Empire.

Therefore we urge the Dominion Government to forthwith inaugurate a more energetic policy of survey, exploration and propaganda relative to the development of such resources particularly in the northern and western areas.

NATURAL INDIGO IN INDIA.

Natural indigo can still compete favorably with the synthetic product, but great improvements are needed, both in the methods of cultivation and in the methods of extraction, especially in the former. By comparing the yields obtained from different plants on different soils, it has been proved that the yields fell off steadily on account of the exhaustion of the phosphates in the soil on which the indigo is grown. It is essential, therefore, that a phosphate fertilizer be supplied, and as its action is very slow, it is imperative that this fertilizing be started at once. Unfortunately, the planters, on the whole, do not seem to realize the necessity of taking such a step, and unless they see the error of their ways, natural indigo will gradually disappear from the market. The initial cost would very soon be recovered, and as indigo commands such a high price since the beginning of the war, it is hard to understand why such a measure has not already been adopted.—W. A. Davies, in Agricult., J. India, XIII., No. 3, July, 1918, through Chimie & Industrie, II., No. 2, Feb., 1919.

HYDRAULIC POWER IN ITALY.

The total utilization of electricity in Italy far surpasses one million horse-power. During the war hundreds of thousands of new hydraulic horse-power were developed in Italy, whilst new projects of exploitation amount to nearly a million horse-power. Italy lacks coal and imports from eight to ten million tons a year. Fuel production is limited to lignite and turf, to which firewood must be added. Although many of Italy's railways are being prepared to be electrically operated, yet Italian imports of coal will always remain high.

AUSTRALIAN STEEL PRODUCTION INCREASES.

A report issued by the Broken Hill Proprietary Company, Melbourne, Australia, states that during the four weeks ending February 5th, 1919, production in its iron and steel works at Newcastle, N.S.W. broke all previous records. Under the open-hearth system, 16,710 tons of steel were produced. Changes were made in Nos. 5, 6 and 7 furnaces, and in this department 5,038 tons of steel were turned out in one week. No. 2 furnace working regularly, produced 12,549 tons in the four weeks, while the foundry furnace accounted for 1,825 tons of iron.

CEMENT JOINTS IN USE.

Cement in place of lead for the joints of cast-iron water mains has been used by the Bureau of Water Works of Portland, Oregon.

According to the Engineer of the Bureau, one pound of cement at half a cent per pound will satisfactorily take the place of three pounds of lead at eight cents per pound, so that there is a material saving in cost. The labor of making the joints, however, reduces this saving, because the cement joints have to be kept wet for from 36 to 48 hours. The joint is first packed with yarn and oakum, and then cement is forced in.

OUTPUT OF TRAIL SMELTER.

During the war the smelter at Trail, B.C., specialized on zinc, and a very large amount of zinc was turned out at this smelter, no less than 21,800,932 pounds in the years 1917-18. In all 374,889 tons of ore were treated during these two years yielding 52,917 ounces of gold; 1,708,692 ounces of silver; 38,844,946 pounds of lead, and 7,982,903 pounds of copper. Practically all of the zinc was used in shell-making.

SHEARING STRENGTH OF CONCRETE.

The Emergency Fleet Corporation, faced with the problem of constructing ships of concrete, found it necessary to make tests of concrete beams in order to determine the proper design of construction for these vessels. As a result of the tests made, it was found that in the case of deep beams the standards heretofore accepted had been too low and that much larger shearing stresses could be used with safety. The investigation is not complete as yet, but the studies so far made will have an important bearing upon the use of concrete in other structures such as buildings and bridges. In some cases concrete has not been used because of limitations in shearing strength imposed by the standards that have prevailed up to the present time, but with the standards revised there will be an opportunity for a wider use of concrete.

The extensive development of mining properties in British Columbia during the past few years is again attracting British capital. About twenty-five years ago this Province was a favorite field for investment for British capital, but unfortunately many of the ventures did not prove successful. However, these unpleasant experiences are being rapidly forgotten so that further English investments are being made at the present time, stimulated, no doubt, by the success which has followed the efforts of American capital to develop British Columbia mining prospects.

TURPENTINE OIL AND ROSIN.

According to a report from The Forest Research Institute, Dehra Dan, India; the tree Boswellia serrata may be made to produce a very good turpentine. The industry is just getting on a small commercial basis, but both the turpentine and rosin produced are known to comply with all the requirements of paint and varnish makers who are familiar with American products.

The annual meeting of the Montreal Metallurgical Association was held in the McDonald Chemistry Building, McGill University, on April the 15th, at 8.15 p.m. Dr. Alfred Stansfield read a paper on "The Possibility of Electric Smelting of Iron Ores in Canada." A practical demonstration of the electric smelting of iron ores was given.

DESTRUCTION AND RECONSTRUCTION.

The Reactions on the Chemical and Related Industries.

After an absence of four months in Europe, Mr. M. L. Davies, Vice-president of the Standard Chemical Co., Ltd., was warmly welcomed at the April meeting of the Toronto section of the Society of Chemical Industry, and there was a general demand by the members for his impressions of the situation in England and France, and the prospects of restoration after the waste of war in France.

Briefly, but with graphic touches, he referred to his visit to Arras, Lens, Lille, Vimy Ridge and other points on the western front that made his hearers wish for a wider audience. Mr. Davies sketched the effects of the war, and stated frankly the problems that have to be dealt with before the industrial machinery of the peace era can be put in good running order.

There are three elements, the loss of which will prevent the full and immediate restoration of industry. The first, and most important, is the loss of life—of man power. Second, the destruction of industrial plants, and, third, the wrecking of the means of transport, such as railways, canals and roads. Over a million and a half of the best sons of France lie dead, and this loss is a drain upon the labor efficiency of the south and west of France, as well as the devastated north, and the desolated plains of Belgium. Then the wrecking of factories and machinery of all kinds postpones the application of skilled labor to those industries, on which the prosperity of pre-war days depended, and even if this could be immediately made good, the means of transport are lacking. Many canal locks were blown up and the canal beds mined. Of the large number of locomotives, tank cars and other rolling stock demanded under the conditions of the Armistice, a very smal percentage has been received, owing to the fact, as claimed by the enemy, that large rolling stock had been lost in Russia, the Balkan States and elsewhere.

Then there is the difficulty about fuel. The immense coal fields of Lens in northern France have been so completely destroyed that new fields will have to be opened up, new shafts sunk, and several years must elapse before the mines can be productive on the pre-war scale. This situation will be met to some extent by the arrangement just completed to permit France to work the Saar Valley coal fields for a prescribed period.

Mr. Davies was able, through the good offices of Sir Geo. E. Foster, Canadian Minister of Trade and Commerce, to secure military permits to visit the Standard Chemical Co.'s plants at Pont a Vendon, near Lens, and at Worms in Germany. The former was found to be entirely destroyed, and the latter in good condition. The plant in Worms was confiscated upon the outbreak of hostilities, and was worked by the German authorities right up to the Armistice.

In the devastated area of France, all factories that were not wrecked by bombardment were systematically destroyed by hand. For example, locomotives and railway equipment that could not be sent beyond the German lines were wantonly destroyed, the locomotives being exploded and tanks dumped into the river. Even the cement foundations were wrecked. In short, everything is worse than lost, as the equipment has become debris, which must be cleared away before reconstruction can be commenced.

The French manufacturers, nevertheless, are facing the future with great determination and an eagerness to return to pre-war basis. What impressed Mr. Davies deeply was the wonderful spirit of the French people. He referred to meeting the managing-director of a large cement manufacturing company, whose works were near the Standard Chemical Co.'s French plant. This gentleman, in addition to his investment in the cement company, had personally a large income from mortgages and other securities, but as these were all in the devastated area. the destruction wrought upon them was complete, and, therefore, principal and interest alike were swept away at the hands of the despoilers.

"How unfortunate!" was the natural remark.

"On the contrary," was the reply, "I am lucky. My mother and sisters lived in the south of France during the war, and are still alive and in good health, and my brother, who served at the front, has come back alive; I served three years at Verdun and was a prisoner for a year and have come through it all, and, although we are penniless, I am on the spot where I was born, although there is not a house with a roof over it. I am alive; I am in good health, and the best of all 'WE WON!'"

Turning to the situation in Great Britain, Mr. Davies considered it providential that the threatened troubles with the miners and the railway and transport workers have been averted, for upon the operation of these groups all industries depend. In coal mining alone over 1,110,000 men are employed above and below ground, while over 600,000 hands are employed in railway and other transport.

It now remains to shift the industries from a war to a peace basis, and here it may be said that chemistry is the basis of the entire industrial fabric. When the output of chemicals is good, all other trades are prosperous, as there is scarcely an industry, from agriculture to scientific apparatus, that is not governed in a more or less degree by chemistry. There is a great future for Great Britain in these fields, but we cannot expect a full development immediately, for the consolidation of the finer and more complicated industries are dependent on supplies from "key" products. This reconstruction might have come sooner, had it not been that when the Government started to select from the army what are known as the pivotal men, there was an

outcry that this was not fair to the men who had gone out in the early days of the conflict, and this method of selection had to be abandoned in favor of demobilization by seniority.

In spite of all mistakes, there is a spirit among the people and the leaders of industry that will not be conquered, and although it may be deferred for a time, the great pre-war chemical trade of Great Britain will certainly be re-established.

The great natural resources of Canada places her in a phenomenal position to develop the chemical trade, not only for her own consumption, but to enable her to bid for the world's markets.

Mr. Davies found that what Canadians have done in this fight for freedom has raised the name of Canada high in the esteem of the British and French people, and as a consequence, he predicted that many thousands would soon turn their footsteps hither from the Old Country.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

Separation of Suspended Particles from Gases, H. A. Burns, 188877, Feb. 25, 1919. Gases are passed through an electric field in which aunidirectional discharge is maintained and a stream of fluid is interposed in the path of the charged particles.

Anode Connectors, J. H. Gillis, 188867, Feb. 25, 1919. Al with Cu.

Drying Nitro Compounds and Recovering Solvent Separated Therefrom, Wm. C. Cram, Jr., 188801, Feb. 18, 1919.

Special Alloy of Pig Iron, K. Ibe, 188631, Feb. 11, 1919. One to 5 per cent Ti and 1 to 5 per cent. of V is incorporated with Fe in the presence of not less than 5 per cent. of Si.

Processes for Concentrating Ores, R. G. Hall, 188585, Feb. 4, 1919. Ores containing Zn, Pb and other metals are roasted, mixed with a reducing material and a small amount of S material to form a matte with the other metals of the ore; the charge is then heated in a reverberatory furnace to reduce and volatilize the Zn and Pb and to conc. the other metals, such as Cu, Ag and Cu in the form of a matte. The waste material is eliminated as a slag free from the valuable metals of the charge.

Smelting Lead, T. W. Cavers, 188629, Feb. 11, 1919. In the blast furnace smelting of Pb ores the charge is heated essentially by blasting in carbonaceous fuel.

Apparatus for Ore Concentration, Wm. O. Arzinger, 188626, Feb. 11, 1919. A fluid jet to impinge on the surface of a liquid, with accessory apparatus.

White Gold, David Belais, 188628, Feb. 11, 1919. Fine Au 75 to 85 per cent.; pure Ni, 10 to 18 per cent., and pure Zn, 2 to 9 per cent. are used and thoroughly mixed together to produce a substitute for Pt.

Process of Treating Oxide Ores, Selden Irwin Clawson, 188548, Feb. 4, 1919. Oxide ores are fluxed in proper proportions with a halogen salt of the metaloid group.

Treating Liquids from Suspended Particles, V. M. Goldschmidt, 188808, Feb. 25, 1919. Liquid in a soln. of salts of Fe and Ti are freed from suspended solid particles by pptg S in the liquid and removing the solid particles.

Treating Aluminous Ores, H. A. Richmond, 188745, Feb. 18, 1919. Carbonaceous material and a sulfid is mixed with aluminous ore, the mixture submitted to electric heat and the impurities are removed as gaseous sulfid. Elimination of the silica is thus satisfactorily obtained.

Electric Melting Furnaces, J. D. Shipton, 188727, Feb. 18, 1919. The electrodes project inwardly through the opposite walls of the melting chamber and a block of refractory conducting material insulated from the walls of the furnace is supported above the ends of each pair of electrodes.

Alcohol from Sulfite Cellulose Liquors, R. H. McKee, 188638, Feb. 11, 1919. The liquors are treated under oxidizing conditions with BtS, thus producing $BaSO_4$, and eliminating injurious S compounds.

Pavement Composition, A. E. Schutte, 187504, Nov. 19, 1918. A wear resisting material free from dust filler is mixed with bituminous cement having asbestos fibre incorporated therewith.

Alcohol from Sulfite Liquors, R. H. McKee, 188636, Feb. 11, 1919. Yeast is added to the liquor containing an appreciable amount of free H_2SO_3, and the solution is aerated throughout the fermentation. The alc vapors are recovered by scrubbing with unfermented liquor.

Alcohol from Sulfite Cellulose Liquors, R. H. McKee, 188,637, Feb. 11, 1919. The liquor is treated with $BaCO_3$ under oxidizing conditions, thus producing $BaSO_4$, the sludge is separated and the liquor fermented and distilled to produce alc. The $BaSO_4$ is reduced to BaS and reconverted to the $BaCO_3$ by treating with CO_2, evolved from the fermentation salts.

Aerating Device, J. P. Ruth, 188640, Feb. 11, 1919. A gas diffusion device for use in flotation process comprises a rotary head having a plurality of passages for gas extending outwardly to the periphery of the head and stationary hoods at the outer extremities of the passages.

Electrolytic Cell and Electrode Therefor, A. T. Stuart, 188772, Feb. 18, 1919. The electrode has a rigid back and thin blades arranged at an angle to the back and spaced from one another, the blades engaging the back for the full length of the blades. The spaces between the blades are of the same width for the entire length of the blades.

1, 2, 4, Methyl Hydroxy Isopropyl Benzene, R. H. McKee, 188518, Feb. 4, 1919, is produced by sulfonating "spruce turpentine," forming an alkali metal salt of the acid, fusing the salt with caustic alkali, dissolving the mass and neutralizing the alkaline solution.

Removing Water from Peat, A. Ten Bosch, 188789, Feb. 18, 1919. Peat pulp is forced by gravity through a long vertical tower in which it is subjected to steam treatment at a press greater than atms and thus freed from water which escapes through a perforated cylinder inserted through the tower horizontally.

Chemical, Oils, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

Perhaps were one to use the word so often used in weather reports "fair," he would be best describing actual trade conditions in chemicals in Canada during the past month. In the general market, trading reflected more confidence in the future of the chemical business. There can be no doubt of this. Chemical manufacturers, when interviewed within the past ten days, without one exception, were more optimistic than a month previous. All reported that orders were "picking up," though it is true that most of these were small orders, yet were indicative of a real bottom to the market, which was certainly absent at the commencement of the year. Second-hand materials are still offering on the market, but in an ever-decreasing amount. In regard to the second-hand materials, it may be said that Canadian manufacturers are in a much better situation than are the United States houses. A report from New York states that second-hands are, for the most part, the only factors actually doing anything in the way of active business, while manufacturers are seemingly not disposed to meet the second-hand market prices, but believe that a satisfactory business is developing, and see no necessity for making any effort to meet this situation. The Canadian manufacturers' determination made some months ago not to cut prices to meet the second-hand offers has proved to have been the wise thing, for trading is gradually coming back to the door of the regular manufacturer of chemicals.

"We are still playing a waiting game, but we are optimistic regarding the ultimate future of the industry," was the manner in which a Montreal chemical manufacturer summed up the situation. Dealers in Montreal believe that the signing of peace and the opening of navigation will be two big factors in improving conditions, though perhaps one should not expect too much from the latter, for while some orders are coming in for the opening of shipping, yet they are small in volume, and will probably not bulk large in the year's business.

DYE-STUFFS.

It has been prophesied that, before the close of the present session of the Federal Government at Ottawa, a preference to Great Britain in the matter of dyes will have been made in the tariff. That will, of course, mean the placing of a duty on United States dyes entering Canada. United States dye manufacturers are uniting now in a strong demand to the Washington Government that a license be placed on all dyes entering the States from any market, which will include Great Britain. No less an authority than Dr. W. H. Nichols declared recently in Buffalo that were the United States dye industries protected in this way for three years, the manufacturers would not care at the end of that period what action the Government would take, as they would be able to meet "any and all comers" on the dye market.

SODA ASH.

There is much talk among Canadian chemical men as to how much duty will be placed on United States soda ash entering Canada, so as to protect this young industry. It is said that the soda ash people are going to ask a 30 per cent. duty, but one manufacturer, in discussing the matter, was willing to wager almost anything that the duty, if placed, would not exceed 20 per cent., and would more probably be about 15. In the States, trading in caustic soda and soda ash has recently improved somewhat, particularly in caustic soda, for which some important sales for export purposes have been made.

The sale of government-owned chemicals, alcohol, acids and large stocks of nitrate, is still going on and is having considerable effect on Canadian and American markets. Large quantities of industrial alcohol have been sold back lately and the whole alcohol question has now reached a point where legislation of great importance is pending. It is understood that under the revised Inland Revenue Act that alcohol without the admixture of any denaturant will be available for fuel, light, power or any mechanical purpose, and free from excise duty provided that the manufacture takes place in Canada. This will be a big thing for industrial users in Canada.

The Government, while slowly releasing acids at fair prices, appears to have some difficulty in disposing of sodium nitrate. The consumption on hand does not seem to be readily stimulated and the price is being maintained above that which is likely to produce large sales. In spite of anti-dumping legislation, some companies are feeling the effects of American efforts to sell Government supplies of some products here. These are temporary conditions, but the legislation in reference to industrial alcohol is of great permanent importance.

METALS.

COPPER.

The price of copper in Canada has remained about stationary during the past few weeks, electrolytic selling at 17c. per lb. England has 200,000,000 lbs. of the metal on hand, which is being sold by the Government.

The American Export Committee will not be able to sell abroad until the foreign stocks are disposed of. It is stated that Germany will need 300,000,000 lbs. of copper per year.

The price in the New York market has remained at from 15¼c. to 15½c. per lb. since April 4th. It is the opinion of many traders that the copper situation has passed its worst stage, but none will predict when the industry will really revive.

The Federal Government has been asked to establish a copper refinery in the vicinity of Vancouver. As soon as the present unsettled condition passes, and the copper markets assume their normal status, the necessity of such a refinery will be apparent. The future development of British Columbia copper deposits is assured, as Great Britain, France and Italy have extensive plans under consideration for the electrification of railways, and the construction of electric power plants to be located in the manufacturing and industrial centres, which will require large supplies of copper products.

IRON AND STEEL.

Canadian iron and steel works are showing activity and are preparing for increased production to meet the demands for iron and steel in Europe, India and South America. There is no reason why Canadian iron and steel works should not become active competitors of the United States in South America. Australia is endeavoring to become more independent by smelting her own ores. Labor conditions in England have hampered the trade there considerably.

The dividend of 2½ per cent., payable May 1st to shareholders of the Coniagas Mines, will call for the disbursement of $100,000. This is a total of 5 per cent., or $200,000 paid so far this year. The company went on a dividend-paying basis in 1907, and up to the present time has paid a total of $9,440,000, amounting to 236 per cent. on its issued capital.

The flotation plant, which was closed down in November last, will be set in operation probably within the next few

days, and should add considerably to revenue. Sand tailings from former operations amount to about 155,113 tons of an average value of 3.5 ounces of silver to the ton. In addition to this is 40,000 tons of slime tailings of an average silver content of six ounces to the ton. The estimated value of sand and slime tailings, in ounces of silver, is 782,895.5.

OILS.

Prices have remained at practically the same level, with a slight downward tendency. A most important oil merger took place about the beginning of April, when the Royal Dutch Shell Oil interests acquired control of the Mexican Eagle Oil Co., Ltd., which has oil concessions in five states in Mexico. The Royal Dutch-Shell is largely a British concern, and the British Government has recently been buying the holdings of British citizens in the Royal Dutch combine.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	1.00
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	—15¼
Aspirin, in 100-lb. lots	Lb.	1.75—2.00
Alchohol, grain, bbl., duty paid	Gal.	8.75
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.10—.12
Ammonium Carbonate	Lb.	.11—.20
Ammonium Chloride	Lb.	.15—.20
Benzoic Acid	Lb.	1.50
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per Ton	$25—$30
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	.04½—.05
Chloroform	Lb.	.45—.60
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	.09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.5
Glycerine, drum, C. P.	Lb.	.22
Hydrochloric Acid, carboys, 18	Lb.	.02¼—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¾—.04½
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Potassium Bromide	Lb.	—.75
Potassium Nitrate, kegs	Lb.	.28—.30
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	.45—.60
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.16—.18
Sodium Cyanide, bulk, 98-99% in cases	Lb.	.35—.40
Sodium Nitrate, refined	100 Lbs.	7.75—8.50
Sodium Nitrate, crude, 95%	100 Lbs.	5.25—5.75
Sodium Benzoate	Lb.	1.35—1.50
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bichromate, bbls.	Lb.	.18—.19
Sodium Nitrate	Lb.	.18—.19
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground....ground	100 Lbs.	2.75—3.00
Sulphur, roll	100 Lbs.	4.25—4.50
Sulphuric Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphite, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.80—.90
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06½
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	—10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.....
Cobalt, metal	Lb.	—2.50
Cobalt Oxide, grey	Lb.	—1.65
Copper, casting	Lb.	—.17
Copper, electrolytic	Lb.	—.18
Copper, electrolytic, in car lots	Lb.	.17
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.07
Lead, in car lots	Lb.	.06⅜
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.01⅛
Spelter	Lb.	.09—.09½
Spelter, in car lots	Lb.	.07
Steel, mild	100 Lbs.	—5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 guage	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.33
Motor Gasline (service stations)	Gal.	—.36
Lighting Gasoline	Gal.	—.38
Naphtha	Gal.	—.32
Coal Oil	Gal.	—.19½
Fuel Oil	Gal.	—7.50
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	35 to 40c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 30c	per gallon
Dip Oil, 20 per cent.	35 to 40c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Flake	.08½ to .09½c	per pound
Naphthalin Balls	10½ to 11½c	per pound
Alpha-Naphthylamin	45 to 50c	per pound

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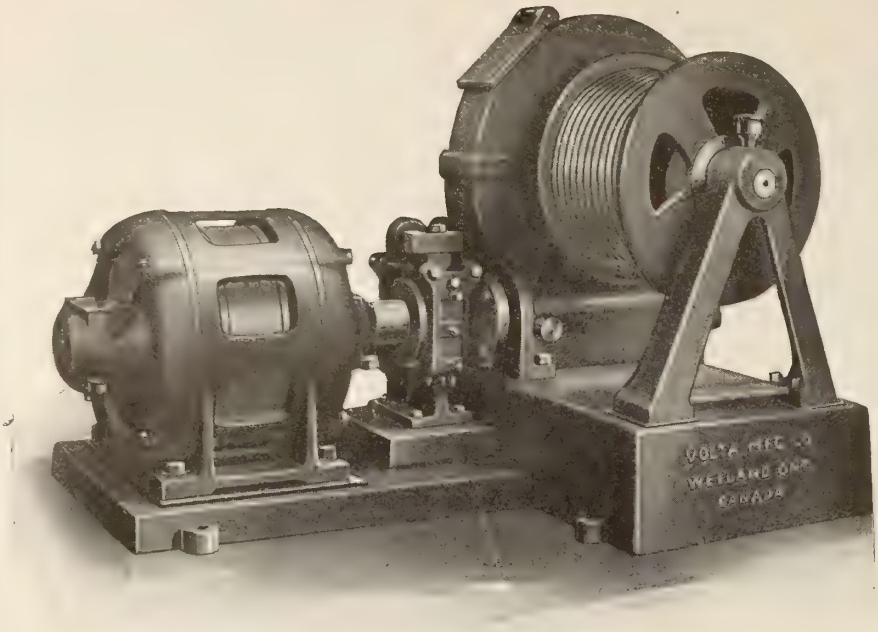

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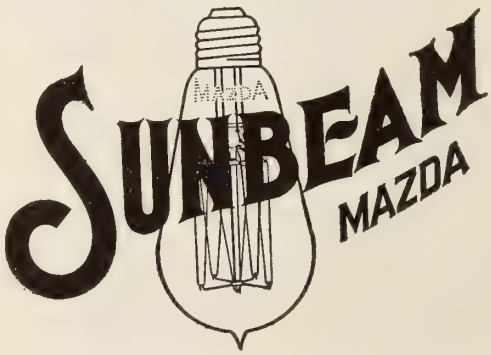

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November 26th, 1918.

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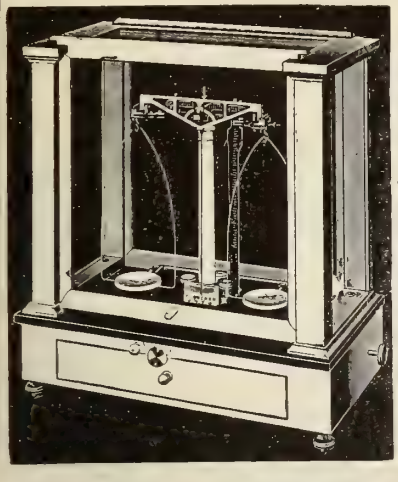

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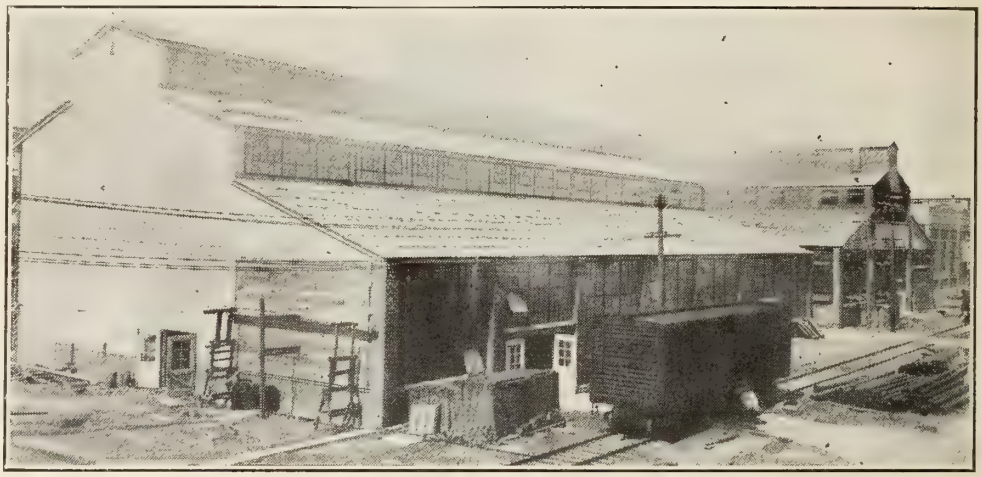

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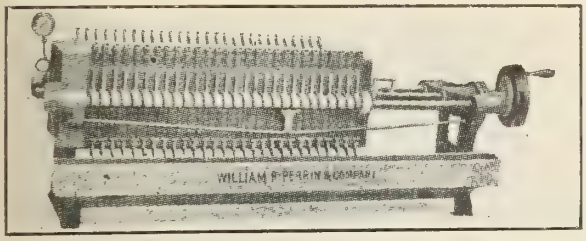

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DEPARTMENT OF LANDS FORESTS & MINES
BUREAU OF MINES

G. H. FERGUSON, Minister

Apart from the products of the farm, those of the forest and of the mine are of special interest to the chemical and metallurgical industry of America. Ontario's forest and mineral wealth is receiving wide attention and offers great opportunities for the investment of capital.

Forests: Pulpwoods in abundance afford the raw products for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically every mineral with the exception of coal and tin is found in the premier mineral province of Canada. Preliminary figures of output as compiled by the Ontario Bureau of Mines show a valuation of $80,165,720. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:—

Silver	$184,976,626	Nickel	$138,010,436
Pig Iron	78,920,722	Gold	50,864,925
Copper	49,947,080	Cobalt	5,916,834

Non-metallic products include actinolite, arsenic, barite, cement, clay and shale for ceramic industries, corundum, feldspar, fluorspar, graphite, gypsum, iron p rites, lime, mica, mineral waters, natural gas, petroleum, quartz, salt, sand and gravel, stone for all purposes, and talc.

Industrial Opportunities: Midway between West a l East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities both by rail and water are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Hydro-electric power both potential and developed is available. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula. For list of publications, illustrated reports, geological maps and mining laws, apply to

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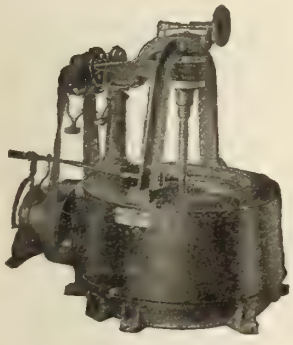

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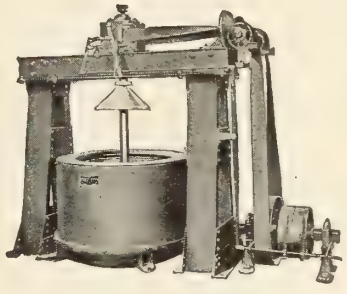

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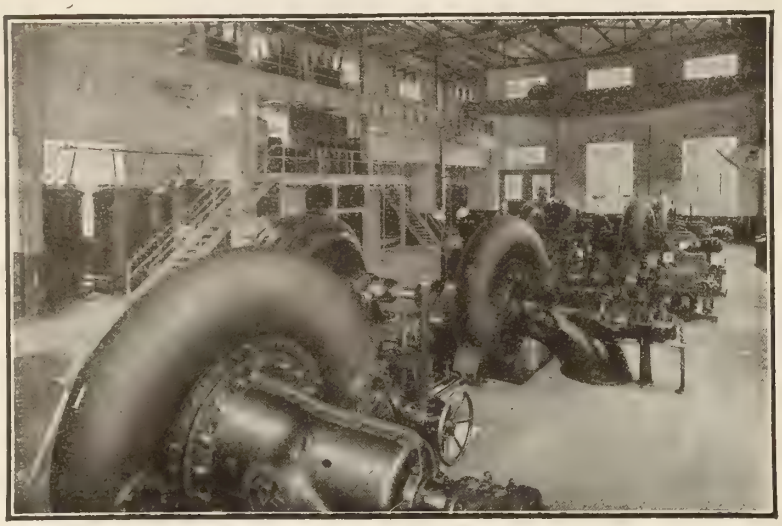

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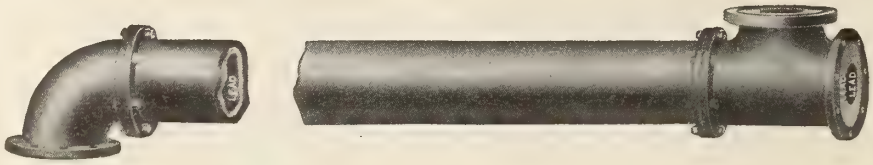

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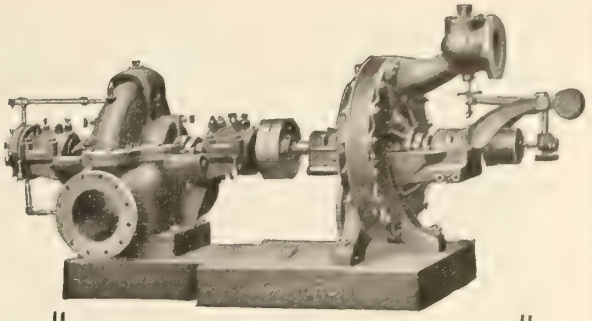

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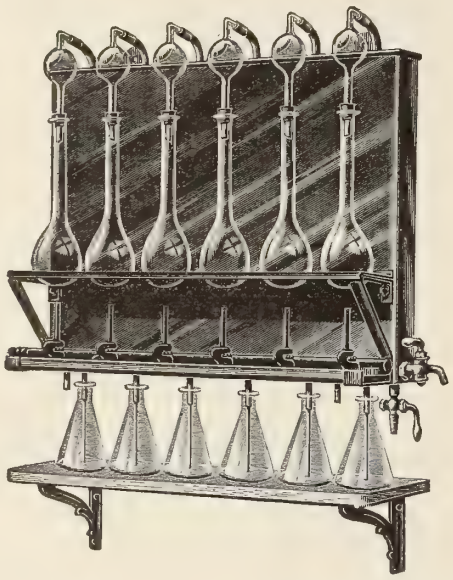

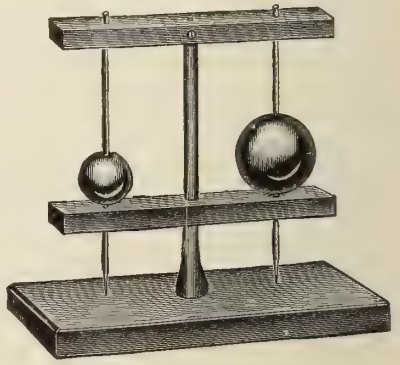

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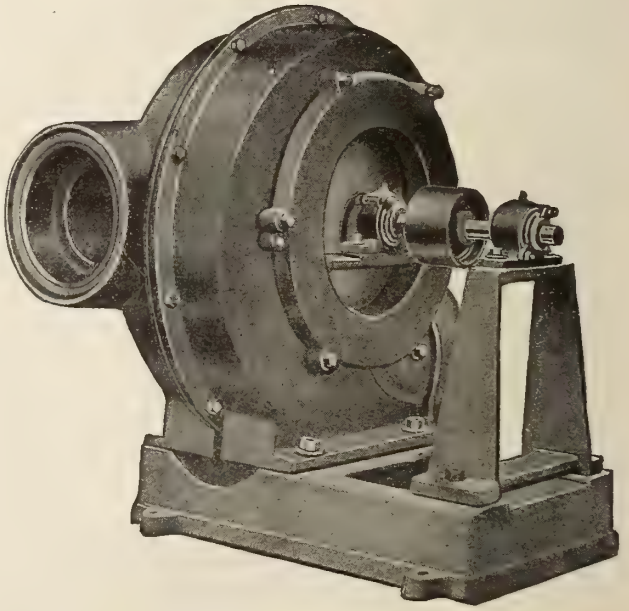

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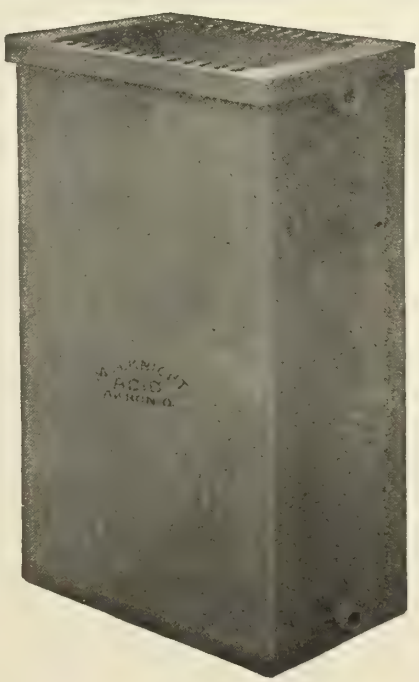

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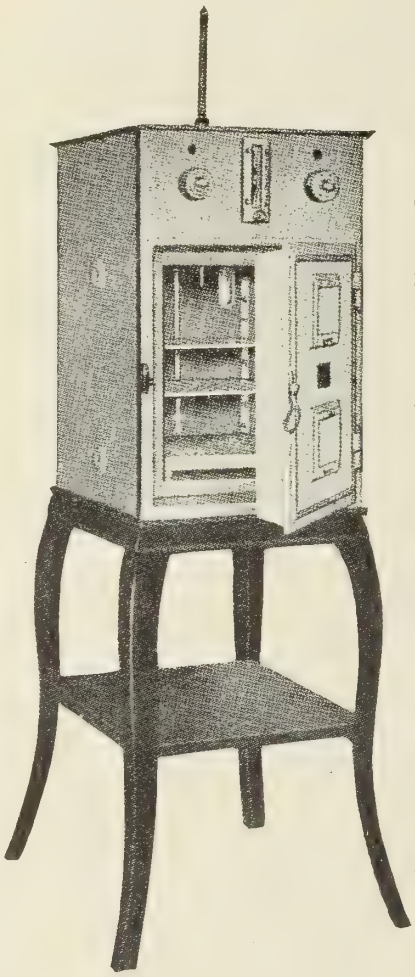

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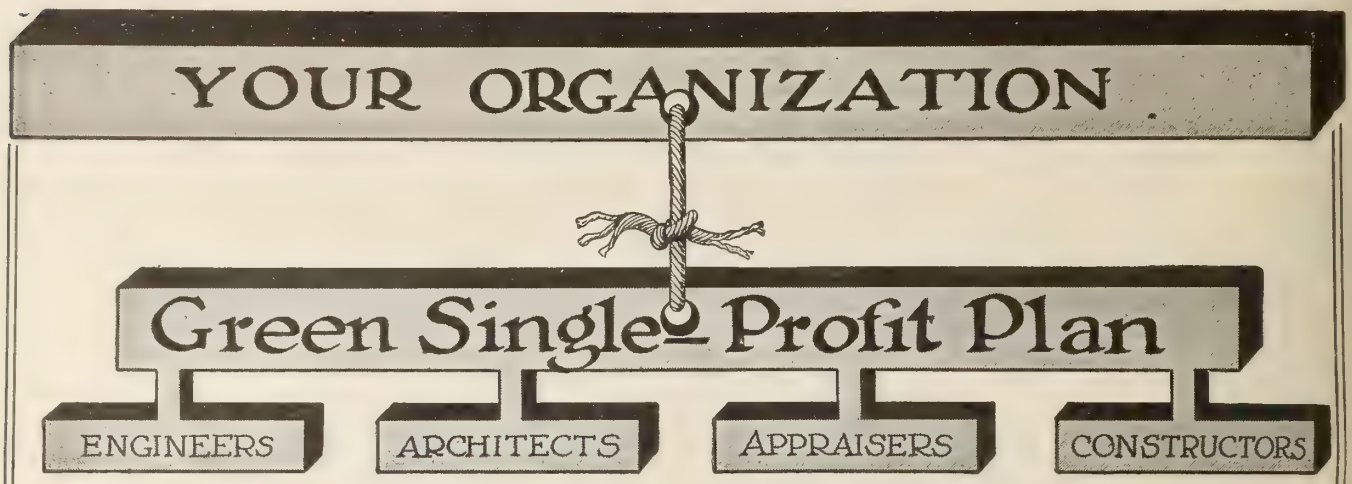

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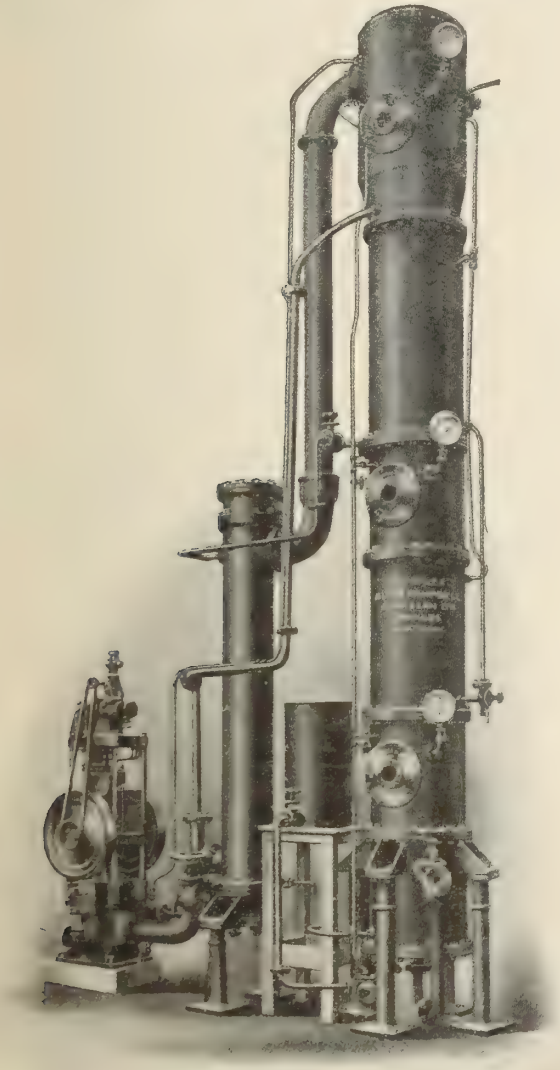

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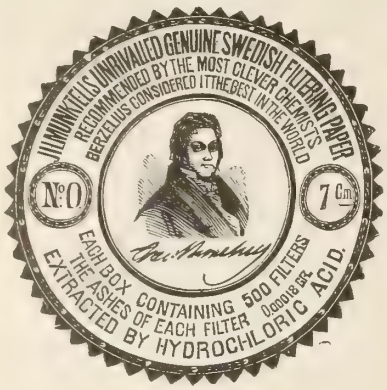
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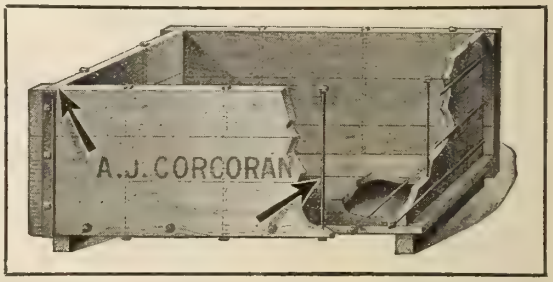

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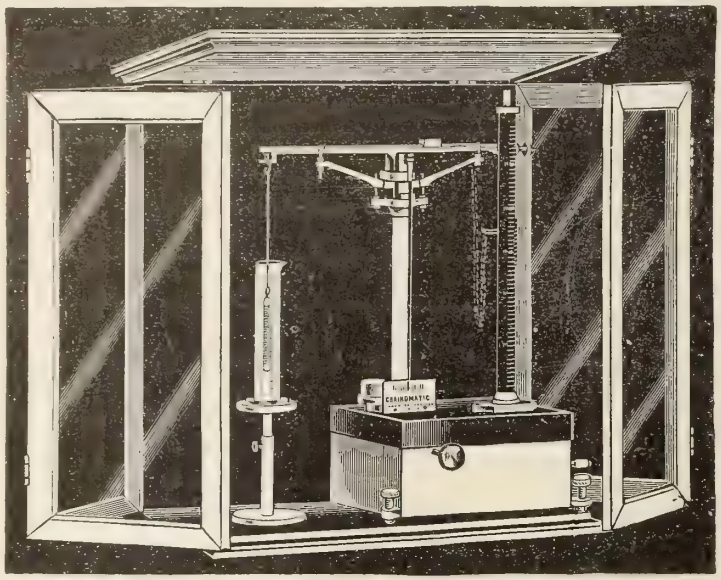

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The Editor will be pleased to receive for publication, original papers from chemists, engineers and managers dealing with the results of Canadian research work or descriptive of Canadian resources and their development in any way. Special arrangements of a very satisfactory nature will be made regarding reprints when required.

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

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WHO ARE INTERESTED IN CHEMISTRY?

IT is a very remarkable fact that those who are best known as chemists by the general public are less interested in chemistry than any others, who have a right to use the designation. Chemistry has long since come to be a very broad science. Its fundamental nature has been the essential cause. The time has come, however, when some very strange attitudes are taken, not only by individuals, but by some companies. We have manufacturing chemists in Canada who stoutly maintain that neither they nor their business are in any sense interested in technical chemistry. They cling tenaciously to the name, but with them personally chemistry is a lost science. Others employ chemists, but when questioned regarding the interest of their business in chemistry, it is found that there is no connection, and as far as they are aware, there never has been. Manufacturers and compounders of essences will admit, for example, that a steel mill may be interested in chemistry, but they certainly are not and never will be; that is quite definite. Another large class who deny their interest in chemistry are certain dealers in chemicals, apparatus and machinery used in manufacturing processes of a special nature. They all shy when it is suggested that they might be interested in chemistry.

Those chemists, who are also pharmacists and druggists depending upon which way you look at their stores, form a very large class who are not interested in the science of chemistry in any way. They refuse to have anything in common with chemists who are graduates of universities in either Arts or Engineering. The wholesale drug houses are of two classes. Some of these will admit that they are interested in chemistry; others claim total exemption.

The factors which have brought about this condition are not a few. The pharmacist, druggist, chemist, from the nature of his numerous points of contact with the community at large, has been able to define the popular conception of what a chemist is. Those in charge of the training of these men are well

aware that neither doctors nor druggists ever obtain more than a very elementary knowledge of the principles of chemistry. Industry has carried along with it types of chemists who have failed to impress the average business man with their necessity in his organization. He is, therefore, not supposed to be interested in chemistry. He really does not know the power of science, if properly applied to his work. The fine points are never considered and a measure of success has been reached, in spite of a hearty disregard for the really technically trained man. Canadian manufacturers, in many instances, trail gloriously behind the average in their conception of what efficient chemistry could and would do for their industrial development. Government action reflects this lack of knowledge regarding matters of fundamental importance to our national welfare.

Chemistry was originally an interesting academic hobby. Here and there it received a commercial boost as a lucky strike brought it to the attention of some capital. Now it has millions invested behind it and still we have only made a beginning in the matter of creating general interest in chemistry. If a different viewpoint is possible or a different name available, every effort is made to submerge the chemical side of the given problem. Of course, people are more and more interested in the work of chemists in applied chemistry, but chemists themselves must broaden their domain.

As the field of the chemist widens, so does industrial development advance. It may be that interest in chemistry will come when lawyers are found taking preliminary courses in chemical engineering and business men point to chemistry courses for their sons as stepping stones to the direction of the world's work.

Chemistry is to industry as air to life. We unconsciously use or abuse its principles. While everyone is interested in chemistry, the universal function of the science really tends to narrow the circle of those who realize their relationship.

THE NEW LEAVEN.

THINGS are coming along. When a western mayor meets a western industrial development committee at Ottawa, and tries to show eastern representatives that there are others who are very much interested in manufacturing and non-agricultural industries, it is time for the east to reform its opinion of affairs on the prairies.

This Journal has been advancing the doctrine now taken up by this committee for study. Mayor Brown, of Medicine Hat, may be classed among those who are not afraid to carry the spirit of the west into new industrial territory. From Manitoba to British Columbia, there are some men who can see beyond the narrow limits of agricultural possibilities and passing strike conditions. They see clearly that the policy of just getting people on the land and then presupposing that they are going to become suddenly happy and prosperous, as is the opinion of some Cabinet ministers at Ottawa, will eventually split the country into camps, which will be continually struggling over unsolvable tariff and trade difficulties.

Population, without due regard to kind or condition may become a clog to industrial development. China has a great population, but the development in recent centuries has been so narrow that the present condition is relatively worse than the former. India might be mentioned and Japan also until a real development policy was started.

Agriculture alone in the west must rapidly alter its course. Land robbery must give place to an annual expenditure in fertilizer materials of about $100,000,000, if the land is not to show a net loss for the year in fertility. It is very unwise to delay action until necessity compels a modification of method. Those who are anxious to see an all-round development in every province do not appreciate the narrow-minded policies of some of our leading representatives. Western Canada is anxious for the best future for her sons and daughters. In the fresh vigor of newly realized resources, it is but natural that an effort will be made to forestall action which would tend to cripple industries in the making. The east must share its factories and be content. Grain growers are becoming aware of the new possibilities since the interest in coal, oil, gas, metals and the general expansion of northern resources is being unfolded.

Any government which does not give a fair measure of attention to these new industrial voices from the west is certainly making a very big mistake. If any province in Canada was contented to go on forever depending on its agricultural resources alone, we would be far off our true path. City, town and country prosperity must all run side by side, if Canada is to become a well-balanced nation of any size.

It is now considered quite a joke when the name of some new department is suggested. There is the idea that the number of Cabinet ministers is too great now. This may, indeed, be true, but the variety of viewpoints represented in the Cabinet is certainly not great enough. All the superficial indications of industrial prosperity are represented, but there is no one there who represents the real fundamentals. There is no vitality at the core of the organization, therefore, positive policies of development are not stimulated and encouraged, and, instead of a group of men guiding our nation, the picture is rather that of a small boy hanging on to the mane of his head-

strong steed. Our Cabinet ministers need summer courses in elementary science and some lessons on the real principles behind industrial development. Population is not the solution, nor does population necessarily lead to a full measure of development and prosperity. Brain power and carefully made plans, based on really scientific principles, embracing all our natural resources and blending them into a full development policy in every province is what we need to-day. The man who can grasp the whole field will become this super-cabinet minister in the Government of the future.

THE ESSENTIALS OF INDUSTRIAL PROSPERITY.

GETTING away from the extremes of high tariff and free trade, there are two facts which must be driven home when discussing present industrial situations. Canada has an enormous debt, the interest charges being close to ninety million dollars per annum, and we are a people who could increase our exports in value and decrease our own imports if we were all properly organized to do so and had the will to succeed. After much boiling, this not only seems to be the substance of the residue, but is also the only way in which our burden may be carried. The hopeful thing that makes it worth while living in this country is the fact that Canada has the resources. What is discouraging and what tends to blast the efforts of those willing to start in the right way at our task is the general lack of conception and the narrow viewpoint taken by those who are elected to power for the purpose of considering business in a national way. Gentlemen become obsessed with fear that if they do not stand in the mob, a sudden blight may sweep down upon them. Echoes are re-echoed until the din is terrific, and yet the simple facts are clear and the opportunity in this case seems to be calling repeatedly.

There is a danger in the word "normal." If by this is meant the pre-war situation, it would be a disastrous condition to revert to. How does it come about that a nation like Canada, which could organize for war on such a wonderful scale, feels dizzy at the thought of organizing for the industrial pursuits of peace. This national debt must be met in the same way as the common enemy was received. In place of this conception, we find that our efforts are rather individualistic. Each company, or loosely connected group of allied capitalists, starts in its own way, and we have forces within our boundaries tending to disunite such efforts as are initiated. A new industrial Canada must be one of the products of the war, and unless we attain this, we will not reach the position we should hold with any speed whatsoever. It seems very simple, and we all know that prosperity depends on the extension of trade. It is not the extension of some particular things, but the broad advance of all lines and all resources. We need real industrial co-operation nationally guided along with some clear thinking on the part of labor leaders and the directors of national effort.

Such a conception must become a policy, and it is the struggling birth of this policy which we are now observing. If a Union Government is possible, it must advance an industrial development policy which will cover all our industries. The basic industries must be selected and pushed along all lines. The "key" industries must be guarded, and when our machine begins to move in gear, it will not be hard to build up the details and the finer industries which depend on the smooth running of those underneath. What is needed now is industrial vision of the possibilities, and then a hearty effort made to co-ordinate work. It may necessitate complete revolutions in some Government departments, but it would be well worth while. The most important business of the country will not long rest tucked away under the blind eye of any department of the Dominion Government. Provinces may hold industrial councils and create new departments, but the nation has not declared war on its national debt or shown that it will survive the struggle until Ottawa has placed first things first, and has given industry a national organization of leaders, capable of co-ordinating our industrial progress along really scientific lines of production and trade expansion.

CONVENTION RESIDUES.

THE chemists of Canada are alive. That was demonstrated absolutely at the Convention in Montreal. That they are a body of very independent thinkers was further illustrated by their ultimate action in matters of organization. We can now welcome the Canadian Institute of Chemistry as an independent organization of professional chemists, banded together for purposes most beneficial to the industries they represent.

It was pleasing to note the Dominion-wide scope of vision shown, and the splendid feeling of co-operation existing between the Society of Chemical Industry and the Canadian Institute of Chemistry. The past year has shown the beginnings of what the Society of Chemical Industry may do if the work is carried on enthusiastically. We need these forces very much in our national life. As we pass through the stage of exhilaration at the prospects of our wonderful natural resources, we come to the period where more complicated industrial machinery becomes necessary before a harvest may be reaped. The old methods must go, and such groups of men as are represented in the Society of Chemical In-

dustry may do much towards bringing the life-giving touch of applied science and research to our problems.

The Canadian Institute can rightly hope to unite all the chemists of the Dominion, no matter from what country they may have come. Every chemist working here should feel it his duty to support a national Canadian institute.

In the course of time, great developments in organization will come. There seems to be a place in every country for two distinct groups of chemical societies. The aim should be to link up in some international way these various bodies. We must first, however, strive for complete unity in Canada, and it would seem very wise to make an effort to combine all our industrial chemical societies under the most logical organization, "The Society of Chemical Industry," having but one Section for the Dominion. A beginning in this direction was suggested at the Convention. As for the Canadian Institute, if its members seek rather to learn what they may do for it, rather than what they may draw from it, influence, power and usefulness shall certainly be the rewards.

FOR THE MANUFACTURER.

IT is regrettable that more manufacturers do not see that success has come to larger companies through the direct use of chemists in their organizations. In Europe, this has been realized; in Japan and the United States, the last ten years have demonstrated this fact over and over again. If a big industrial plant needs a chemist, it follows that a smaller one really needs two or three. These men should be considered as liaison officers. They are types of efficiency engineers. They make the best of salesmen when trained and are capable of directing purchases better than anyone else. They will produce as many good ideas per week as any other class of professional man. They are trained to consider carefully both the most minute details of the problem, as well as the larger aspects. The idea that the chemist should be left in the laboratory is an absurdity. He should be given a chance in every post of the organization.

There is no industry possible where a properly trained chemist cannot carry forward the work that has been put where it is by the application of concrete scientific principles. In the oil, paint, rubber, steel and metal industries, as well as agriculture, it has been the chemist who started things, and it is through the laboratory that success has come; but the big mistake is made when these men are left in the laboratory. They should be continually absorbed by all parts of the organization. As a manufacturer, you must take time to cultivate the acquaintance of at least one good chemist, whether you employ one or not. Tell him your troubles and let him apply his viewpoint. Do not force him to call himself an engineer or some other special name to gain your attention. It's the type of training that chemistry gives that you need and not the particular name which counts. There are not many elements after all and the chemist knows more about how they behave than anyone else. This is the simple truth, and unless you have someone with you who has the known fundamental facts of science at his command and who can relate them to what you are trying to do, you cannot get ahead.

THE INDUSTRIAL ALCOHOL SITUATION.

AFTER being very close indeed to a really fine solution of the industrial alcohol question in this country, it would seem at this time that some influences were still powerful enough and sufficiently foolish to block the recent Bill brought up to amend the Inland Revenue Act.

The Society of Chemical Industry and a representative body of chemists at their Convention in Montreal passed a resolution strongly upholding the proposal that alcohol for light, heat, power and industrial uses be manufactured in Canada free from all excise tax. There are some things that our legislators either willingly fail to understand, or are improperly qualified to grasp. The social side of the alcohol question seems still to be the only one in evidence. Industrial alcohol, at cost of production, should be made immediately available, in order that the multitude of processes depending on its use may not be handicapped. The possibilities of pure ethyl alcohol in the garage should appeal to all motor car owners. This question should not be longer put off with a smile and a passing joke, but should receive immediate attention directly aimed at the fostering of alcohol-using industries within the country.

THE LATEST CLASSIC FIASCO.

WE have become very tired, indeed, repeating the same old story of how the Dominion Government, after going to considerable trouble in preparing a place for research workers and technical men in general, always neglects to provide a suitable salary. The latest classic fiasco is the history of the staff of the Forest Products Laboratory, Montreal. These civil servants were, as a group, capable of carrying on the best kind of research work for the whole Dominion. Where the Government failed to recognize merit by cash returns, specific companies have not, and we can only congratulate all members of the original staff on leaving the service. We do not believe that the grading of technical men in the Dominion Civil Service is absolutely rotten, but to say the least, it is very imperfect.

WHERE ARE THE ENGINEERS?

THEY are busy in their own fields rushing along as capital directs. They also meet lean periods and those more remunerative. They are continually fabricating the signs of our growth and expansion, but as a body of professional men, are they awake to industrial problems in Canada as they should be? While there are most brilliant exceptions and many men among the engineering organizations who are towering strengths to the industries, they are connected with, and to sane social and labor movements within the country, it would seem that there are many more who have lost all conception of the growth of Canada nationward. While doing the thing, they have forgotten the significance of the work. The Government does this and that and the engineer proceeds to build. It is a question again if his voice should not be heard a little more in broader fields. He has an enormous, silent influence on industrial development, but he should have a stronger voice. It is the business of the engineer to do the engineering, but a loss results from the low measure of enthusiasm shown by engineering societies in matters of policy connected with industrial developments. Going to the Government with legislation furthering organization propaganda is good, but coming out with some support for positive action in many industrial matters would be much better. If you are capable of doing the work, your opinion should be of some value when discussing what ought to be done.

MEETING OF ROYAL SOCIETY OF CANADA.

The proceedings of the Science Section of the Royal Society are always interesting, and this year many very valuable papers were presented at the May meeting.

Canadian scientific men have done much more than is generally known in matters of research and invention in connection with the war. Prof. J. C. MacLennan, of the Department of Physics in the University of Toronto, presented some of the work done by Canadians for the British Admiralty. Most valuable work in anti-submarine warfare, in the production of helium, and the design of electrical devices, must be credited to Canadian genius.

A noted American visitor was Prof. Dayton Miller, of the Case School of Science, Columbus, Ohio, who in his address told of the work done at Sandy Hook Proving Grounds in measuring the pressure, velocity and forms of air waves from the discharge of large guns. This work was necessary to a study of the nature of shell shock.

Dr. R. F. Ruttan, of McGill University, Montreal, has been elected president of the Society for the coming year.

SCIENCE AND PUBLIC HEALTH.

The annual convention of public health officials was held in Toronto on May 27th and 28th. The advances in laboratory work are continued, and the general attention of the public is being greatly increased in matters of this kind. The war has shown up the physical weakness of the nation, and the State, through its new department at Ottawa, can do much towards bettering conditions and educating the masses. Several papers of merit were given; Dr. O. Codham, of the Board of Health, Winnipeg, Vaccines in Influenza; Seymour Hadwin; Protein Sensitization from Parasites; Wilfrid Sadler, Vancouver, The Bacteriology of Swelled Canned Sardines; J. H. Allan, Ontario Veterinary College, Toronto, A Preliminary Study in Bacteriology of Jellied Meat Products.

OVER $1,000,000 FOR QUEEN'S UNIVERSITY.

The Queen's University Million-dollar Endowment Fund has been oversubscribed by $2,500. The campaign for this fund started in January, 1918, when the offer first made in the spring of 1917 was renewed, by which the University would receive half a million dollars from the estate of the late Chancellor Douglas, provided a similar amount was raised by the University authorities. Principal Bruce Taylor announced on January 31st, 1919, that the Carnegie Fund trustees would donate a quarter of million dollars. The largest subscription was given by the University Registrar, Mr. G. Y. Chown, who at the beginning of the campaign donated $50,000. Mr. Alex. Longwell, of Toronto, subscribed $15,000 and Mr. E. R. Peacock, of London, England, donated $10,000.

PREVENTING THE GROWTH OF CAST IRON.

Amongst the fascinating problems which make engineering science at once a most exacting and a most fruitful study, the characteristic behavior of metals under varying conditions provides many curious cases. For example, grey cast iron grows appreciably in volume when exposed to high temperature. This characteristic, which causes much trouble in cast dies, valve seatings and other parts, is believed to be due to internal oxidation caused by the penetration of hot gases into the metal. A remedy recently suggested in England is to eliminate free graphite from the surface of the metal, this being the cause of its porosity. Successful results have been obtained by annealing the parts for several days in iron rust at a temperature of from 1,650 to 1,830 degrees fahrenheit.

IMPORTANT SCIENTIFIC DISCOVERY.

Absolute proof that the gravitational attraction between masses of matter varies with changes in their electrical potential, due to electrical changes upon them, was obtained by Dr. Francis E. Nipher in a year of experiments in the laboratory of Washington University, St. Louis.

PERFECTION IN DISINFECTANTS.

It is stated that since the New York Department of Water Supply added a small amount of chlorine to the water, not a single case of typhoid fever has occurred which could be traced to the city water. A far more remarkable achievement in water purification, however, is presented by the equipment devised by British chemists for the use of the army in France. It was so perfect that an equipment on a barge could pump foul water from a canal and deliver it in large quantities purified for drinking purposes. In view of the New York success, it is proposed that chlorinated water be used for sprinkling the streets to prevent the spread of infection.

Chemists from every part of the Dominion in attendance at their Montreal Convention, May 16-17, 1919.

Second Annual Convention of Canadian Chemists and Regular Annual Meeting of the Society of Chemical Industry

ON the 16th and 17th of May, both the above organizations held most important joint meetings at the Windsor Hotel, Montreal. For those who are not perfectly familiar with the development of chemical societies in Canada it may be explained that the Society of Chemical Industry is Empire-wide and, in fact, international in its scope. In 1902 the first branch in Canada was established in Toronto and since that time the growth of the society has kept pace with the industrial development of the country. Branches of this Canadian section have been since established in Montreal and Ottawa. In November, 1917, the chemists and manufacturers of Vancouver organized the Canadian Pacific section of this society. Manitoba and the Maritime Provinces have their own independent chemical organizations. The Society of Chemical Industry has a broad field and includes in its membership all those who are interested in chemistry in any way.

In May, 1918, the first convention of Canadian chemists was held in Ottawa and at this meeting an organization committee was appointed with Prof. M. A. Parker as chairman and H. J. Roast, of Montreal, as secretary. During the year, and after much thought, a plan of organization was worked out and this became the basis of the discussion at the convention in Montreal.

The Society of Chemical Industry came to its annual meeting after the most successful year in its history in Canada. The membership has been greatly increased in all branches and the importance of the organization has been realized in a larger way by an increasing number of business men and manufacturers.

It could only be expected, then, that an exceedingly lively annual meeting and convention should follow and there was no disappointment. Two days were found to be far too short to do justice to the program and discussions. On Friday, following registration, papers were given by Mr. J. R. Donald on "The Inspection of Explosives and Chemicals During the War," and by Mr. A. F. G. Cadenhead on "Some Shawinigan Falls Chemical Industries." In both papers the wonderful work that had been accomplished by Canadian chemists and engineers was manifestly evident. The quick grasp of the situation and the sense of the importance of what Canada could do is a record of achievement not surpassed by any other country in the war. At the time the Ministry of Munitions had everything to do at once and there were few skilled technical men available. Under the pressure, things were done and research accomplished in periods of months which in normal times would have taken years, or would probably never have been initiated in Canada at all. Both papers were well illustrated by slides.

The afternoon of Friday was devoted to visiting some of the industrial plants of the city. The choices available were the St. Lawrence Sugar Refineries, Ltd.; Canadian Consolidated Rubber Co., Ltd.; Dominion Glass Company; Canadian Vickers, Ltd.; and the filtration plant. Any one of these plants offered large-scale operations for study, and it must be admitted that every care was taken in explaining plant operations. Instead of being hurried through for fear that someone might pocket some of the machinery, every one was given some time for observation and conversation with the guides. At the St. Lawrence Sugar Refineries over one million pounds of raw sugar are refined every day, while the work of the Canadian Vickers plant is well known on account of the enormous efforts in shipbuilding made there during the war. Their floating drydock is of special importance to St. Lawrence shipping. The Canadian Consolidated Rubber Co. was busy in all departments and ample evidence was available to show that no possible precautions were left untaken in the matter of safety devices and ventilation. The glass industries of Canada have also received their share of expansion and look forward to expanding trade abroad.

Formation of Canadian Institute of Chemistry.

For Saturday, a program of papers had been prepared, as well as arrangements for a full discussion of organization plans. Messrs. Speakman and Newman presented papers on the manufacture of acetone by a fermentation process and the production of M.E.K. (Methyl Ethyl Ketone) from

Members of Executive of the Society of Chemical Industry at the Montreal Convention of Canadian Chemists, May 16-17, 1919.

normal butyl alcohol. From lack of time these papers were only presented in part, but will receive full publication later. The work done by the British Acetones, Limited, of Toronto, in this connection was of the very greatest importance, and represents a new standard for production by such a method. The problem was one of complete sterilization on a large scale and as worked out was most successful. The necessity for acetone was very great and for a time this Toronto plant was producing over seventy-five per cent. of the total supply for the British Empire. The processes were illustrated from slides forming a wonderful record of good bacteriological and chemical engineering. Mr. J. A. Dawson, chairman of the Canadian Pacific Section of the Society of Chemical Industry, presented a well illustrated paper on the growth and development of chemical industries in that province. The market available from Vancouver, taken along with the known resources of the province, makes it certain that manufacturing industries of the greatest magnitude must rapidly spring up. With coal, iron, oils and electric power backed up by forest and agricultural wealth, the future of this province is bright indeed.

The really big interest of the convention was the launching of the new Canadian Institute of Chemistry, and it may now be said that the ship was most successfully started on its way with a very excellent captain and crew. The operations, however, were not finished without news items of considerable interest. The Chemists' Organization Committee had prepared a program of procedure and a report which was given in full in this Journal in April. In general, it was decided that a purely Canadian organization of chemists was most suited to conditions in the Dominion. Two classes of members in this association were recognized: Fellows and Associates. The exact qualifications, as officially revised, will be given later, but they are essentially as outlined in the original report. University graduates in chemistry and those who hold positions of importance in industrial plants or are thus engaged in other chemical work, will be eligible as Fellows, while those who are engaged in chemical work, but have not qualifications as determined by an examining body in the Institute, will be eligible as Associates. The age qualification for the fellowship is 24 years. There seemed to be very little doubt but that the majority present favored a purely Canadian Institute—Dominion-wide in scope. Some difference of opinion arose regarding the proper methods of procedure, but it was evident that all hoped for positive action. It was finally decided that the question of original members should be solved by appointing a representative committee who would form the nucleus of the original membership and whose duty it would be to elect a chairman and executive, who, in turn, would carry on the work of organization. It would be fruitless to detail everything that was said in a discussion which lasted for several hours. The report was considered clause by clause and every effort was made to have procedure go forward on a sound basis. In the end, the above object was very successfully accomplished. Twenty-eight representative original members were chosen as a nucleus from which an executive could be selected. They were chosen in such a way that every province would be represented. This rather interesting list is given here in full and includes all members of the original organization committee:—

British Columbia—J. A. Dawson, Vancouver; Dr. D. McIntosh, Vancouver.

Alberta—J. Kelso, Edmonton; Prof. A. Lehman, Edmonton.

Saskatchewan—Dr. R. D. MacLaurin, Saskatoon; T. T. Thorvaldson, Saskatoon.

Manitoba—Dr. F. J. Birchard, Winnipeg; Prof. M. A. Parker, Winnipeg.

Ontario—Dr. F. T. Shutt, Ottawa; Dr. A. McGill, Ottawa; Capt. J. Race, Ottawa; S. J. Cook, Ottawa; Prof. J. Watson Bain, Toronto; Prof. W. L. Miller, Toronto; Prof. E. G. R. Ardagh, Toronto; Alfred Burton, Toronto; Prof. L. F. Goodwin, Kingston; Dr. W. L. Goodwin, Kingston.

Quebec—Dr. J. S. Bates, Kenogami, P.Q.; Dr. A. T. Charron, St. Hyacinthe; I. Grageroff, Montreal; H. J. Roast, Montreal; Dr. R. F. Ruttan, Montreal; Dr. George Baril, Montreal.

New Brunswick—Dr. H. E. Bigelow, Sackville; A. F. Blake, St. John.

Nova Ccotia—C. C. Forward, Halifax; Prof. E. MacKay, Halifax.

Papers had been prepared by Prof. J. W. Bain on "The Chemical Activities of the Canadian War Mission," and Capt. E. T. Sterne on "The War Efforts of Chemists in Explosives." These were not presented at the convention but it is expected that they will be published in later reports.

The Annual Banquet.

The visiting chemists were able to unite a most pleasant time with the business of the convention. A theatre party

on Friday and the annual banquet the following evening, gave everyone an outlet for the expression of their social nature, and both were well attended. The closest kind of co-operation was everywhere in evidence between the Society of Chemical Industry and the Canadian Institute of Chemistry. Large common interests must always unite these organizations and this division of chemical labor can only end in the general development of a larger interest in the importance of chemistry to industry. The Institute of Chemistry will be able to rightfully claim the attention of Provincial and Dominion Governments because of the technical qualifications of all its members, while the Society of Chemical Industry will link up the technical men with the business world and should be found a great factor in bringing about a keener public conception of the relative position of chemistry in the industrial development of the country. At the banquet Dr. W. L. Goodwin, chairman of the Canadian Section, presided along with the real guardian and secretary of the Society in Canada, Alfred Burton. Among those who spoke at the banquet were Mr. Doust, who has but recently returned from France after an extended business trip; Mr. T. H. Wardleworth, of the National Drug Co., Montreal, whose interest in the growth of the Society in Montreal has had much to do with its success; Prof. E. G. R. Ardagh, of Toronto, who invited the chemists of the Dominion to hold their next annual convention in that city; Mr. H. J. Roast, the secretary of the Canadian Institute, and J. A. Dawson, of Vancouver. Mr. Dawson pointed out the possibilities of amalgamation of all the Canadian interests of the Society and expressed the hope that this would soon be arranged.

Mr. Alfred Burton, the honorary secretary of the Society of Chemical Industry, gave a resume of the growth of the society during the year. There are now 278 members in the Canadian section, twelve of whom were on active service. During the year forty-eight new members and fifty-eight associates were added as follows: Ottawa, 2 new members and 21 associates; Montreal, 12 new members and 11 associates; Toronto, 34 new members and 26 associates, or a total of 106 new members.

The following gentlemen were elected as an executive committee for the Society of Chemical Industry: Dr. W. L. Goodwin, chairman; H. Van der Linde, vice-chairman; Alfred Burton, honorary secretary. Council—Messrs. E. G. R. Ardagh, J. W. Bain, W. L. Miller, W. H. Thom, M. L. Hersey, C. R. Hazen, and T. H. Wardleworth.

Branch committees for the year were elected as follows:

Montreal Branch—Mr. R. Job, chairman; Geo. D. McIntyre, secretary. Committee: Messrs. I. Grogeroff, P. H. Holland, C. R. Hazen and R. M. MacLean.

Ottawa Branch—Dr. F. T. Shutt, chairman; S. J. Cook, secretary. Committee: A. E. MacRae, E. Stansfield, R. E. Gilmore, M. F. Comner, F. J. Hambley.

Toronto Branch—Prof. E. G. R. Ardagh, chairman; T. L. Acton, secretary. Committee: Messre. J. W. Bain, M. L. Davies, H. E. Rothwell, D. G. Buchanan, H. Van der Linde, L. E. Westman, C. F. Thurlow (associate representative).

Several resolutions were passed, dealing with such important matters as the disposal of chemical patents held by enemy countries in Canada, the necessity for cheaper alcohol, and the advancement of education within the Dominion. Mr. C. Hazen introduced a resolution strongly recommending that the legislation before the House of Commons designed to supply excise free pure ethyl alcohol for industrial purposes be adopted by the Government. Mr. S. J. Cook, of Ottawa, moved a resolution pointing out the desirability of action at securing for Canadian manufacturers enemy-owned patents before the signing of the peace treaty made this a more difficult matter. Action was urged in this connection by Mr. H. C. Heitman and Mr. A. MacRae.

A resolution was moved by J. N. Stephenson and supported by Dr. Milton Hersey, recommending compulsory education up to the age of 14 years, with a possibility of continuing for two years longer. The Ministers of Education in all the provinces were urged to support further training in citizenship and advance both the salaries and requirements of many classes of teachers.

The secretary of the Chemists' Organization Committee, Mr. Harold J. Roast, was remembered in a practical way for the efforts he had put forth during the year in starting the work. Every movement has been the result of push, sacrifice and faith on the part of individuals, and while the whole committee were untiring, Mr. Roast led in the work.

Professor J. W. Bain.

Prof. E. G. R. Ardagh and L. E. Westman had the privilege of expressing the hearty thanks of the chemists of Canada for the work Mr. Roast had accomplished.

Credit is certainly due the Montreal Branch of the Society for the way in which they prepared and carried out their plans to the complete enjoyment of all visiting members and guests.

Exhibits on Apparatus.

A new departure was made for such meetings and it is one which in the future will form an important part of all conventions. Several firms took advantage of the opportunity offered and displayed literature, apparatus and machinery. Among these were Canadian Laboratory Supplies, with a full line of laboratory apparatus, chemicals and equipment; The Hoyt Metal Co., showing lead-lined apparatus, tubes and valves; the St. Lawrence Sugar Re-

(Concluded on page 192)

Magnesium Sulphate Deposits at Basque, B.C.

A description of recent development work in connection with the recovery of Pure Magnesium Sulphate from Lake Deposits

By GEORGE C. CRUX

THE natural resources of a new country unfold themselves gradually. Within the last year an entirely new industry has sprung up in British Columbia surrounding certain magnesium and sodium salt deposits. Of these, perhaps, the most promising commercially has been the discovery of a chain of lakes near Basque, B.C., from which very pure magnesium sulphate may be easily obtained in quantities not hitherto available.

Location and Description.

These deposits are situated at Epsom Spur on the Canadian National Railway, three miles from Basque, which is located on both the Canadian Pacific and Canadian National Railways and are within two hundred miles of Vancouver. There are in all five deposits in this immediate vicinity, all of which contain high percentages of magnesium sulphate. They are now known by numbers and designated as follows: Lake No. 1 (containing 6 acres); No. 2 (containing 5 acres); No. 3 (containing 4 acres); No. 4 (containing 3 acres); No. 5 (containing 2 acres). Lake No. 1, the largest of the five deposits, is at the highest elevation about 1,500 feet higher than the railway, or 2,500 feet above the sea level. Lake No. 5 following down the chain is some 50 feet lower than No. 1. The distance between the lakes varies from 500 to 2,500 feet. The lakes are of the pot-hole or basin variety, and are, of course, in the dry belt, where the combined rain and snow fall does not exceed five inches annually. The deposits are covered with water from six inches to one foot from the last of March until June or July. The hot, dry summer winds evaporate the water very rapidly and for the greater part of the year, the magnesium sulphate may be removed without difficulty.

Exploration Work.

The salts occur in solidified masses of varying shapes and sizes, surrounded by mud rings. Underneath a number of layers is found a solid body of salts. All five deposits are controlled by the Basque Chemical Production Company, of Vancouver, and fairly complete measurements of the deposits have been made. Drilling operations have been carried on to forty feet in depth and the purity of the magnesium sulphate has been found to be remarkably high, indeed. The first three deposits, being larger, are the more important, and a uniform deposition of magnesium sulphate has taken place. It has been recently discovered that the water at lower depths, as it enters the lake, is much warmer than surface water, and it would appear that the deposits are being continually fed from a warmer solution, issuing from surrounding rock sources. The deposition and growth of the deposits is, therefore, continually going on. These deposits may be conceived of as a series of layers underlain by a solid body of salt, chiefly magnesium sulphate.

Chemical Analysis.

Fairly complete surveys have been made and analysis taken of various parts of the deposits.

	$MgSO_4$	Moisture.	In-soluble.	Total Sol. Matter.	Epsom Equivalent.
	%	%	%	%	%
Lake No. 1.					
Sample No. 1..	44.58	50.84	0.75	99.24	91.28
Sample No. 2..	35.64	51.01	1.41	98.59	72.96
Sample No. 3..	43.36	44.98	10.96	89.04	89.00
Lake No. 2.					
Sample No. 4..	42.50	50.15	0.51	99.49	85.04
Sample No. 5..	37.08	35.78	0.52	99.92	75.92
Sample No. 6..	43.70	49.41	0.73	99.48	89.48
Sample No. 7..	37.84	37.98	5.68	99.32	77.48
Sample No. 8..	37.30	39.28	14.66	85.34	76.36

Storing cut of magnesium sulphate at Basque, B.C.

General view of deposit No. 1 of magnesium sulphate at Basque, B.C., showing surface layer ready for harvesting.

Lake No. 3.					
Sample No. 9..	44.80	49.34	3.36	96.64	91.72
Lake No. 4.					
Sample No. 10.	35.68	31.53	3.05	96.95	73.04

Sample No. 1.—Top layer five inches thick.
Sample No. 2.—Second layer three and a half inches thick.
Sample No. 3.—From bottom of test hole four feet below surface.
Sample No. 4.—Top layer five inches thick.
Sample No. 5.—Second layer three inches thick.
Sample No. 6.—Third layer three inches thick.
Sample No. 7.—Fourth layer five inches thick.
Sample No. 8.—Bottom test hole at three feet.
Sample No. 9.—Bottom of shallow test hole.
Sample No. 10.—From thin layer of salts on top of mud.

A more complete analysis of several samples indicated the complete absence of arsenic, lead, iron, zinc, carbonate, phosphate and nitrate and traces only of chlorides and calcium. It is evident then that, while the crystals formed are very small, the purity of large portions of the surface deposits is such as is required by pharmacopoeal requirements. Chemically pure salt is thus obtainable in the natural state, showing by analysis magnesium sulphate 99.5 per cent. over considerable surface areas.

Analysis of Basque Magnesian Waters.

A further exhaustive examination of the mother liquors from which the salts above were deposited has been made and comparative data given from the analysis of several imported aperient mineral waters.

Sample No. 1, from Lake No. 1, is a colorless solution containing a small trace of flocculent organic sediment. The specific gravity and analysis indicate this to be about a 50 per cent. saturated solution of magnesium sulphate.

Sample No. 2, labelled "Solution from Lake No. 2," is a slightly turbid solution containing a trace of suspended organic matter. The solution is highly saturated, contain-

A general view of magnesium salt deposits at Basque, B.C., showing semi-circular structure of deposits.

Source.	Pluto Conc'd. Indiana.	Abilena. Michigan.	Aesculap. Hungary.	Apenta. Hungary.	Hunyadi. Hungary.	Duncan. Ontario.	Sample No. 2. Basque, B.C
Solids	9.1%	5.4%	4.1%	4.0%	3.8%	10.9%	33.0%
Calcium (Ca)	0.6	0.8	1.6	1.1	1.1	trace	trace
Magnesium (Mg)	7.3	0.6	10.3	11.2	7.0	10.0	12.9
Alkalies (Na)	18.4	30.04	15.7	14.4	15.2	16.7	12.0
Sulphate (SO_4)	70.4	66.1	69.0	70.8	74.1	68.3	74.5
Chlorides (Cl)	1.4	1.7	4.0	2.3	1.8	3.4	0.5

Composition of Various Mineral Waters.

ing principally magnesium sulphate and sodium sulphate in the proportion of 63 to 36 of anhydrous salts. On standing at 15 deg. C., crystals separated out. The analysis was made on the solution warmed to dissolve the separated crystals.

The following are the results of analysis of the two samples:—

	No. 1.	No. 2.
Insoluble combustible material (no ash)	faint trace	0.01%wt.
Specific gravity of filtered solution 20/20 deg. C.	1.1673	1.3741
Water on evaporation and ignition	84.55%wt.	66.98%wt.
Water-free material by difference	15.45	33.02

Analysis of Water-free Material.

Magnesium as Mg.	19.97%wt.	12.85%wt.
Sulphate as SO_4	79.90	74.48
Sodium as Na	0.08	11.66
Potassium as K	.....	0.35
Silica as SiO_2	0.01	0.02
Calcium as Ca	trace	0.01
Chlorides as Cl	trace	0.52
Total	99.96%	99.89%

Arsenic, lead, zinc, iron, aluminium absent.

Carbonates, phosphates, nitrates absent. No. 2 gave trace sulphide. No. 1 was alkaline to methyl red, about 1 cc. N/10 per 100 cc. sample. No. 2 was acid to methyl red, about 1 cc. N/10 per 100 cc. sample.

The composition of the solution from Lake No. 2 is such that it would make a good aperient mineral water, low in alkali materials when diluted to a proper extent. The table shows the results of analysis of some common brands of mineral waters found on the market. (Results are per cent. weight.)

Mineral constituents are calculated to per cent. on water-free material.

Quantity Production.

Computing the first layer of magnesium sulphate on Lake No. 1 to be over five acres in area and to have a uniform thickness of five inches, there is immediately available an amount of high-grade technical magnesium sulphate approximating 6,000 tons. It is very evident that the available Epsom salt is several times this amount as the proven depth in one place is 40 feet, and from the nature of the deposits, it is evident that the whole lake carries a high percentage of commercial magnesium salts, notably free for the most part from sodium. Sources of pure water are available in the immediate vicinity for leaching purposes.

The physical chemistry and the geology of this great natural source of magnesium sulphate offers an excellent problem for research. Nature has provided the raw material in solution and in a most ingenious manner has erected a system of evaporators. In this instance, very little remains for man to accomplish.

Undoubtedly, the immediate mining, shipping and refining of these deposits will form a most valuable and permanent industry for Canada, as technical uses in the tanning, textile and other industries are increasing, while a Canadian source of highest-grade medicinal salts for human and veterinary use is assured very shortly.

NEW NAMES FOR CHEMISTS.

The Council of the Institute of Chemistry of Great Britain has drawn up a memorandum dealing with the securing of an established professional status as scientists for chemists who are employed in the British Government service.

The Council regard it as important to remove the confusion existing in this country from the use of the title "chemist" by those who practice pharmacy. In France, the ordinary word for one who prepares and sells drugs is pharmacien, and in old English the term "apothecary" served the same purpose, while another distinctive term, "druggist," still keeps up a precarious existence.

Before the Civil Service Commission in 1912 representations were made as to the unsatisfactory conditions of service and remuneration offered to chemists by Government departments. In their present memorandum, the Council urge the adoption of adequate and uniform conditions of appointment for chemists directly engaged in the service of the State, and the restriction of such appointments to men with recognized qualifications. As the candidates would have to produce evidence of qualification, it is suggested that appointment should be based on a system of selection by properly constituted authority and not by mental title), deputy chief chemist, superintending chemist, should be graded as civil servants in the higher division, preferably as members of a professional division, if such should be constituted, with status, emoluments, and pension comparable with those of the members of other technical and learned professions employed by the Government.

The following titles are suggested for different ranks: Chief chemist (with, in certain cases, a special departmental title), deputy chief chemist, superintending chemist, principal assistant chemist, senior assistant chemist, and junior assistant chemist. There would be a secondary staff to whom the title "chemist" would not be applicable. This should comprise chemical assistants, laboratory assistants, and laboratory attendants. The chemical assistants, it is suggested, should, however, consist of men of good education, who, on obtaining full professional qualifications, would become eligible for appointment as chemists.

Natural Deposits of Salts of Magnesium and Sodium near Clinton, B. C.*

By L. REINECKE

Some 33 miles north of Ashcroft, where the Canadian Pacific railway, in its way through the mountains, turns suddenly southward to Vancouver, is the small frontier village of Clinton. It lies on the Cariboo trail by which a stream of gold seekers passed on their way from the coast to the Cariboo placer diggings early in the sixties. Southwest of Clinton are the formidable canyons of the Coast ranges, but to the north there is a vast area of plateaus and rolling hills, sections of which are as truly plain-like as any part of this mountainous province. This portion of the Interior Plateaus, lying between 2,500 and 4,500 feet above the sea, gets comparatively little rain or snow and there are broad acres at some distance from the deep canyon of Fraser river, within which the drainage is poorly developed and small alkali lakes without outlet abound. The lack of rainfall has given rise to a sparse forest growth interspersed with much meadow land, which affords pasture to large herds of cattle and horses. Here the old-time cowboy is still very much at home, and racing after cattle or wild horses through the pines is considered part of a day's work.

Recently a railway has been projected from Vancouver through the mountains to Clinton, and from there paralleling the Cariboo road and the Fraser river, across the Plateaus to Fort George. In the summer of 1918 the Geological Survey of Canada made a reconnaissance of the mineral deposits near a section of this railway line. The work was done with Clinton as headquarters, and it is with some of the deposits of salts of magnesium and sodium found near Clinton and to the north of it that this article deals.

"The writer is indebted to Mr. F. Calvert of Oroville, Washington, for analyses of, and data on, the hydromagnesite and sodium carbonate deposits, to Mr. A. E. Carew Gibson of Vancouver for information on the hydromagnesite at Watson Lake, and to Mr. Harlan I. Smith of the Geological Survey for the photographs shown in Plates I, II, III, IV and V."

There are two types of deposits to be considered. The first, a series of carbonates and sulphates of calcium and magnesium, are connected in location and origin with areas of metamorphosed sedimentary and igneous rocks known as the Cache Creek series. These were studied at Clinton and at two localities about 25 and 60 miles to the north. There are also deposits of sodium carbonate which seem to be related to a much younger series of basaltic flows.

The chemistry and geology of these deposits have been worked out in part only. They are described now in order to draw attention to their economical value as sources of possible raw materials for the chemical industries of Canada.

The first series of deposits consist of calcium carbonate, hydrated magnesian carbonates, gypsum and epsomite. All of these earths, except certain coherent forms of calcareous tufa, resemble each other so closely that they cannot be separated in the field. Microscopically they are so fine-grained that positive identifications of minerals were only made in a few cases. The chemical analyses, tables 1 and 2 serve to separate them but do not tell in what way they are combined, and microchemical tests failed for reasons that will be given later. All of these appear to be related in their origin but the magnesian salts are of greater present economic value. Only the epsomite has been worked commercially.

HYDROMAGNESITE.

Hydromagnesites or earths approaching that mineral in composition are found outcropping in the flat at Clinton, plate I, at the east end of Meadow Lake, 25 miles to the north, plate II, and at Watson Lake, 60 miles north of Clinton.

The nearly pure hydromagnesites are fairly coherent aggregates made up of extremely fine white to cream colored particles, that show glistening faces with a silky lustre in reflected light. Microscopically they resolve into fine bladed crystals about .01 millimetres long that have optical characters resembling hydromagnesite.

Below these there are almost invariably to be found earths containing a high percentage of calcium and magnesium. In the hand specimens they resemble the purer magnesium carbonates closely, but are, in many cases, slightly more yellow or gray. Under the microscope an earth with magnesia and lime in nearly equal proportion was seen to consist of anhydrous

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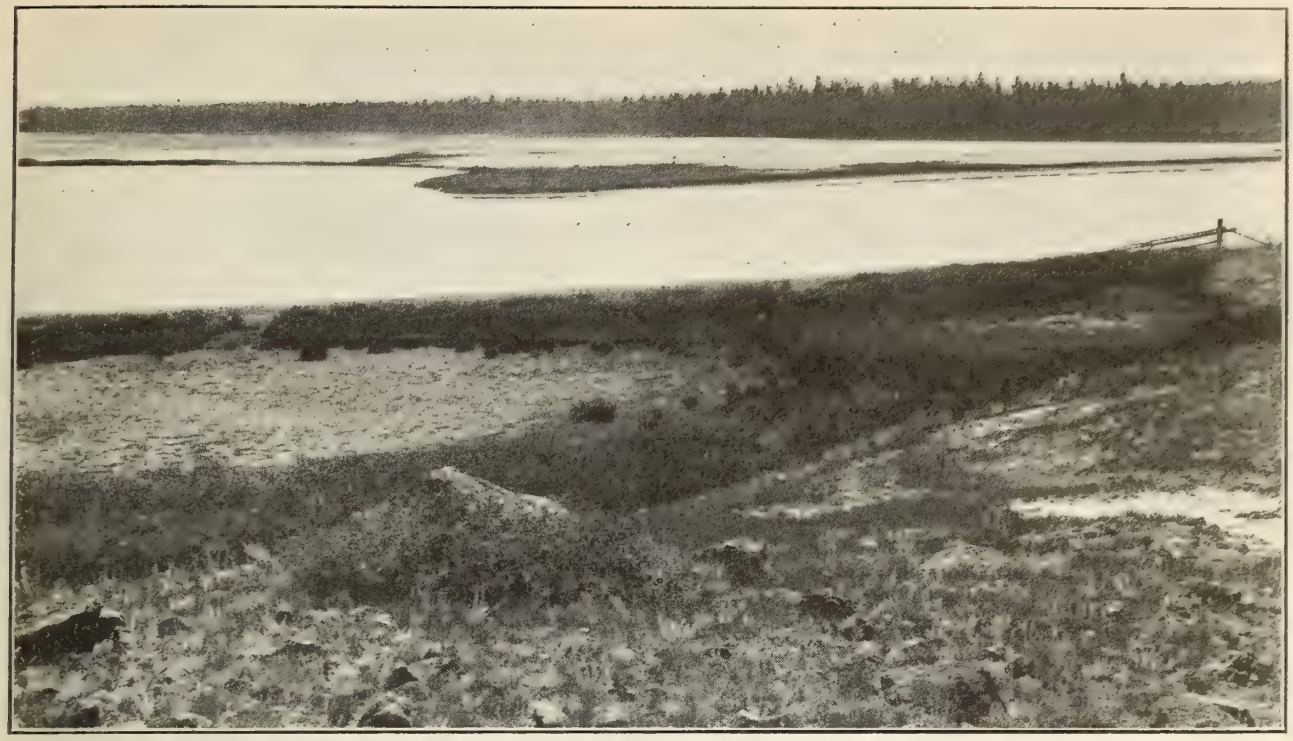
The largest outcrop of hydromagnesite at Clinton, B.C., in foreground; railway line in distance, looking west. Photographed by Harlan I. Smith.



The main area of hydromagnesite at Meadow Lake. All of the white surface on the other side of the small lake in the foreground is hydromagnesite.

carbonates with a small proportion of bladed crystals and some clouded material. The high proportion of anyhdrous carbonates suggests that they exist as dolomites rather than as admixtures of calcite and hydrated magnesium carbonate. This will be referred to again further on.

The gypsum and calcium carbonate earths look almost exactly like the hydromagnesite in hand specimens but gypsum could be identified under the microscope.

TEXTURE AND STRUCTURE.

The upper part of the earths are a fine powder. Freshly broken lumps, however, show a fine banding or bedding with flattened cavities having peculiar spheroidal bulges on the walls, lying between bands. This apparent stratification extends downward in the deeper deposits and there are zones or bands slightly different in colour and in the quantities of siliceous and chemical impurities as one descends. The base of the main deposits, where reached by test pits, lie on unconsolidated clay, sand or gravel.

In shape the larger deposits of hydromagnesite are tabular or like the top of a toadstool, thinner at the edges than the middle, while smaller nodular-shaped occurrences of gypsum calcite mixtures are common. The purer magnesite lie on top of the deposits which consist of a number of rounded humps full of radiating cracks and resembling the top of a cauliflower (Plate III). At Meadow Lake the interstices between these rounded cauliflowers are filled with large angular basaltic boulders whose bottoms are several feet below the top of the

Deposit of hydromagnesite at Clinton, B.C., showing cauliflower structure. (Photographed by Harlan I. Smith.)

cauliflowers. The impression gained is that the magnesite patches have grown upward and sideways forcing the boulders to one side. The only excavations in these deposits are test pits and the shape of their bases is, therefore, unknown. They seem to be flat, however, with certain deep spots of small area.

There are also truly bedded deposits such as the marls, forming in the shallow parts of Kelly Lake to-day and seen interbedded with clay and sand in the flat west of the lake. Certain impure deposits of hydromagnesite lying at the east and west ends of Meadow lake at about water level are evidently of this character. The nodular form of deposit is illustrated in Plate IV.

TOPOGRAPHICAL AND GEOLOGICAL RELATIONS.

The purer hydromagnesites outcrop on the surface of flat-bottom lands near the lowest part of the valleys in which they lie. Nodular deposits occur on the hillsides several hundred feet above the valley floor as well as in the bottoms. The larger toadstool deposits seem to lie on unconsolidated sands and clays in most places. At Clinton the surrounding areas are drift covered, but the valley floor and the hills for several hundred feet above it are underlain by actinolite schists, carbonaceous argillites, fine grained quartzites and, possibly, limestones of the Cache Creek series of Carboniferous age. At Meadow lake Tertiary basalt beds, although not out-cropping, are evidently close under the hydromagnesites, but at the west end of the lake there are impure hydromagnesites with Cache Creek rocks, apparently close under. At Watson lake the valley is drift covered with basalt hills to the southwest, and rocks resembling the Cache Creek lying to the northeast.

†Thope E. A Dictionary of Applied Chem., Vol. I, P. 611.

COMPOSITION.

The composition of the hydromagnesites and certain impure earths occurring near them is given in tables 1 and 2. In seeking to arrive at the mineral composition from the chemical analyses the lime present was combined first with all the sulphate present to form gypsum and anhydrite, the remaining lime was calculated as lime carbonate. The carbon dioxide remaining after the lime was satisfied was calculated as if it had combined wholly with the magnesia and water of crystallization to form hydrated magnesium carbonate.

Gypsum† loses three-fourths of its water of crystallization when heated for some time at 100° Centigrade: only three-fourths of the water driven off below 105° Centigrade could, therefore, be combined, which necessitated the calculation of some of the high gypsiferous earths as anhydrite. Whether anhydrite is actually present, a question of great geological interest, can be proven only by further microscopic work.

The combination of the lime and magnesia carbonates as mixtures of calcite and hydrated magnesium carbonates is based upon the results of work by Johnston* and the hypothesis that the deposits under discussion have been formed at or close

Nodular deposit of gypsum lying at the surface of the ground above boulder clay.. The white streaks in the clay below are small rivulets filled with the same material as the nodule. (Photographed by Harlan I. Smith.)

to the surface of the ground under conditions of temperature and pressure, approximating that of the atmosphere.

The microscopic appearance of earths made up of nearly equal mixtures of lime and magnesium carbonate indicates, however, that there is very little hydrated magnesium carbonate present, and probably a good deal of the material is combined as the double carbonate dolomite CaMg (CO3)2. This would also be of great geologic interest if true, but the ordinary microchemical tests to determine whether dolomite is present fail in this case. For while they are based on the greater ease with which carbon dioxide separates from calcite rather than dolomite. these earths all contain hydrous magnesian carbonates in excess and they give up their carbon dioxide more readily than calcite, so that an apparent test is obtained for calcite even in a purely magnesium earth. The analyses show that the hydrated magnesian carbonates are indefinite combinations of magnesium carbonate and water of crystallization rather than hydromagnesite, 3MgCO3. Mg (OH)+3H2O. Although iron carbonate is a common constituent of magnesites there is so small a percentage of ferrous iron present that it has been disregarded. Analyses 3 and 4, table 1, reveal a condition characteristic of many of the larger deposits in that the upper two feet or so is nearly wholly magnesium carbonate, and that is underlain by material carrying a high percentage of lime. This is of the greatest importance from the commercial point of view. Analyses 4 to 8 at Clinton are of mixtures of calcite and gypsum lying on a hillside at Clinton, several hundred feet directly above the pure hydromagnesite, Analysis 1, table I.

ORIGIN

The hypothesis put forward to account for the origin of these deposits and of the the epsomite described below, is as follows: The magnesuim and calcium were dissolved from magnesian minerals (serpentine, actinolite, etc.) in rocks of the Cache Creek formation, by waters percolating downward from the surface and charged with carbon dioxide and sulphates, the the carbon dioxide being derived from the atmosphere and from the oxidation of the carbonaceous argillities of the Cache Creek, the sulphates by oxidation of pyritiferous rocks. These waters with their loads of calcium and magnesium continued to descend until the zone of saturation was reached, and then moved along the upper surface of this zone, groundwater table, from higher to lower ground, some of them working their way back to the surface and forming nodular deposits of the more insoluble calcium salts, gypsum and calcite on the side hills, Plate IV. The more soluble magnesium carbonates and sulphates, if present with the calcium, were carried down to the valley bottoms where the groundwater table invariably lies closer to the surface than higher up. Here the magnesian salts and such of the calcium as remained, rose to or near the surface with the groundwater, and were deposited in the bottoms of ponds or on dry land as hydromagnesites. There was a further separation also at this point, the calcium carbonates being either thrown down, first, and the hydrous magnesium carbonates, later, on top and partly mixed with the calcium carbonates or there was a first crop of dolomite thrown down with the excess of magnesian carbonate precipitated later and near the surface as hydromagnesite. The relative solubility of calcite and hydromagnesite is based on the work of Johnston, (see footnote on this page). If sulphates were in excess, magnesium sulphate (epsomite) would be deposited finally and closest to the surface but only in cases where deposition took place in ponds without outlet. This hypothesis is based on many geological facts but it is not possible to discuss them in this paper.

COMMERCIAL VALUE.

The commercial value of the hydromagnesites depends on the quality and size of marketable beds, the costs of quarrying them and transporting them to market, and to the market demands and prices.

The writer has seen no gypsum deposits of workable size but such a deposit is said to have been discovered near the railway one mile east of Kelly lake. The calcium carbonate beds existing as coherent calcareous tufas near Clinton may be worked in the future. A description of these beds which are geologically interesting will appear in the final report.

No commercial exploitation of the hydromagnesites has been attempted as yet, and only a few test pits have been dug. At Clinton, however, a good deal of prospecting has been done in the hills just east of the hydromagnesite by the firm of C.E. Cartwright & Co. of Vancouver, B.C., in an attempt to discover whether deposits of solid magnesite existed in the bedrock below the drift cover. These have not, so far, proved successful.

In calculating the tonnage of incoherent aggregates, such as these hydromagnesites, from their measured cubic yardage, the ordinary method of multiplying the weight of a cubic yard of water by the specific gravity of hydromagnesite will give a result that is far too high, since the voids in the loose and aggregate are disregarded. This difficulty was overcome by Dr. K. A. Clark of the Department of Mines, who determined the "apparent specific gravity," that is, true weight per unit volume, of a number of lumps of the material as they were broken from the deposit in place. He obtained closely concordant results in three determinations with an average value of 1.22. This makes the weight of a cubic yard of magnesite as it exists in the deposit, 2,050 pounds. The outcrop areas were mapped by plane table and chain, and the depths were calculated rom such data as could be gathered.

The main groups of deposits contain a fairly high grade of hydromagnesite from the surface down to 1, 2 and 2½ feet. Below that, except in one or two cases, the material is too high in lime and siliceous impurities to be of commercial value.

At Clinton (Plates I. and III.) the average depth of the purer deposits, which cover less than two acres, is said to be 2½ feet, and on that basis there is about 7,000 tons cropping at the surface. There is a further area of about 24 acres underlain in places by thin beds of magnesite, but probably no part of this area will prove of commercial importance.

At Watkins lake there are five small deposits covering about 5 acres. According to information received from the owner the south-western and largest of these carries about 2 feet of good magnesite underlain by material too high in lime for commercial use. The eastern patch is calculated to carry about 5 feet of high grade material, and the northwestern, 4 feet 8 inches. These, together with the two other small deposits, should produce 25,000 tons of good grade. Some of the analyses made on material collected by the writer are high in siliceous impurities and they show that parts of the deposit cannot be safely worked below 2 feet. The deposits at Meadow lake are much larger than the above (Plate II.) The two main areas cover about 39 acres and are underlain by 2 feet of good magnesite at the surface, over 4 feet of impure stuff. There are additional areas aggregating 8 acres. It is calculated that

*Johnston John. "The solubility product constant of calcium and magnesium carbonates." Journ. Amer. Chem. Soc., Vol. 37, No. 9, Sept., 1915. Johnston concludes that if solutions containing only calcium pressure of CO2 is reduced, at 16° Centigrade, pure calcium carbonate will be precipitated if the partial pressure of CO2 stay slightly higher than it is normally in the atmosphere, and the magnesium concentration does not exceed the calcium by 14,000 to 1. The calcium will be contaminated with magnesium if the presence of a soluble salt of magnesium should change the ratio of concentrations sufficiently. A lowering of the partial pressure of CO2 to that of the atmosphere or less will, in general, also cause the precipitation of magnesium hydroxide with the calcite. Therefore, a small amount of magnesium hydroxide would be expected to come down with the calcite under atmospheric conditions and moreover, since (Foote, H. W. and Bradley, Wm. On solid solutions in minerals. The isomorphism between calcite and dolomite. Amer. Journ. Soc., Vol. XXXVII, April, 1914, pp. 341, 342.) calcite may hold up to 1 per cent. of magnesium carbonate in solid solution at ordinary temperatures and pressures of crystallization, a small amount of magnesium may be included in the precipitated calcite in that manner. After practically all calcite has precipitated if further loss of CO2 and evaporation continue, the magnesium will come down as an indefinite mixture of carbonate and hydroxide, a substance that would readily part with either its carbon dioxide or water.

there are 180,000 tons of pure hydromagnesite available and two or three times that amount of the pure material.

All of these deposits are soft enough to be excavated by steam shovel but it will be difficult to do so without contaminating them with the underlying impure material which resembles it closely in color and texture.

The Clinton and Watkins lake areas are within a mile or two from the new railway line, and the Meadow lake deposit about 16 miles over an easy grade from it. Because of the long rail haul, however, it would pay to calcine the hydromagnesite at the point of excavation as that should reduce the weight to be hauled by nearly sixty per cent.

MARKETS.

Before the war Austria and Greece were the main sources of magnesite for the world, including North America. During war times these supplies were cut off and there was a consequent increase in North American production, leading to the opening up of large deposits in California, Washington and Quebec. The products were utilized mostly in the making of refractory linings for steel and other metal furnaces, Portland cement kilns, etc., and to a lesser extent for digesting wood pulp, for making Sorel cement, the manufacture of chemicals (magnesia alba levis (MgOH. 3MgCO3), magnesium chloride and epsom salt), and a number of other uses.

Before the war crude Grecian magnesite sold in New York at from $7 to $10 per ton; caustic calcined and deadburned material sold at from $16.25 to $35 per ton. In 1917 crude California and Quebec magnesite sold for about $10 per ton at the mine, and the various grades of calcined at from $30 to $50 at the points of production. With the return of peace and the ceasing of munition manufacture, the market for this and other minerals has become unsettled. When ocean freight rates get back to normal the use of crude Cariboo magnesite material will probably be restricted to the western seaboard. The Cariboo magnesites will have to compete in the market for refractories with Washington and Californian products, and in the east with several recent substitutes for pure magnesite. It is possible that larger markets may arise for its use as plastic material in Sorel cement and in other ways. (This article will be completed in our July issue.)

THE AUSTRO-GERMAN BREWING INDUSTRY AND THE WAR.

The first curtailment in the production of beer was voluntary, being due to a large falling off in the demand after mobilization. The succeeding ones were imposed by the blockade: Russia alone furnished Germany with three million tons of barley before the war.

In the spring of 1916, the production was cut down to 60 per cent. of the average production of the two years preceding the war. A little later this was reduced to 48 per cent., then to 35 per cent. for Bavaria and 25 per cent. for the other states, and finally to 15 per cent and 10 per cent.

In Germany, recourse was had to decreasing the density, while in Austria-Hungary, malt substitutes were used.

Decreasing the density impaired the vitality of the yeast, and Will has shown that with concentrations lower than 6 per cent., the yeasts could not be used long. Extremely light beers, 1.5 per cent., and even 1 per cent. extract in the wort were made by diluting ordinary wort with an infusion of hops. To ensure proper keeping qualities, it was saturated with carbonic acid gas.

In Austria-Hungary the use of cereals as substitutes was not prohibited, but all grain was under State control. Sugar, starch, dried potatoes, corn, glucose, natural and artificial honey, beans, dried beets, beet seed, were all tried, but only sugar, glucose, starch and millet gave satisfactory results.—Allg. Z. Bierbrauerei et Malzfabrik, Vol. 46, No. 39, 1918, through Chimie & Industrie, Vol. II., No. 3, March, 1919.

TABLE I.—ANALYSES OF HYDROMAGNESITE DEPOSITS.

	Si.O2	Insoluble Si.O2	A12O3	Fe.2O3	Fe.O	Mg.O	Ca.O	C.O2	S.O3	Cl	Organic Matter	H2O above 105° C.	H2O below 105° C.	Total	Calcite	Gypsum	Hydrated Magnesian Carbonate
1. Main deposit at Clinton, 0 to 2 feet from surface	2.30	——	0.63	0.13	....	41.60	0.22	35.88	0.36	tr.	...	17.53	1.12	99.77	....	0.7	94.9
2. Average of analyses of material taken from 5 pits in two largest deposits, Meadow lake, 0 to 2 feet from surface	1.22	....	0.67	0.18	0.63	40.56	1.26	35.96	....	..	....	18.00	1.45	99.93	2.3	....	93.51
3. Middle largest deposit at Meadow Lake, 0 to 3¼ ft. from surface	13.10	....	1.34	0.11	0.17	36.63	2.86	35.64	0.13	tr.	....	7.00	2.58	99.56	4.9	0.3	77.04
4. Same locality as 2, 3¼ to 5 feet from surface	10.32	....	1.35	0.49	....	24.32	20.12	38.64	0.14	tr.	....	2.93	1.45	99.76	35.8	0.3	50.11
5. Impure magnesite close to east end of Meadow Lake, 1 to 2 ft. from surface	36.78	1.54	0.84	0.59	20.14	9.20	20.24	0.07	tr.	....	6.80	3.52	99.72	16.4	0.2	36.22	
6. From middle of south western deposit at Watson Lake	6.36	0.20	0.12	....	41.06	1.62	38.04	0.08	tr.	....	11.25	1.32	100.05	2.8	0.2	89.10	
7. From near middle of same deposit at Watson Lake, 0 to 4½ feet from surface	10.24	....	0.38	0.16	....	39.33	2.06	35.76	0.21	tr.	....	9.04	2.11	99.29	3.4	0.5	82.59
8. From hole in east end of deposit No. 2 at Watson Lake, 0 to 3 feet from surface	....	4.62	0.16	0.16	....	43.17	1.14	43.64	0.51	tr.	....	5 26	1.42	100.10	1.4	1.0	91.26
9. From Watson Lake exact locality unknown	1.73	....	0.12	0.07	....	43.73	....	37.03	....	..	....	17.79	....	100.90	....	....	....
10. Average of 5 samples from three localities at Watson Lake, at depths of 1, 2 and one case, 5 feet from surface	0.76	....	0.49	0.04	....	44.52	0 (50.65 loss on ignition)										
11. Deposit 1 mile N.N. of Watson Lake	8.62	0.33	0.57	....	36.70	1.54	31.08	0.18	tr.	3.10	14 86	2.21	99.19	2.5	0.3	82.47	

Numbers 1, 3, 4, 5, 6, 7 and 8 and 11 analysed by Frederick Baridon, Mines Branch.
1. This was taken from middle of the best looking deposit in the flat at Clinton.
2. Analysis furnished by F. Calvert of Stewart-Calvert Co., Oroville, Wash., U. S. A.
9. Analyzed by R. A. A. Johnston, Ann. Rep. G.S.C., Vol. XI., 1898, p. 11R.
10. Analysis furnished by the owner, A. E. Carew Gibson of Vancouver.

Inspection of Explosives and Chemicals During the War Period*

By J. RICHARDSON DONALD, Inspector of Explosives for the Imperial Ministry of Munitions, Canada

AS a chemical engineer I have for some time felt that, while in a general way the important role played by chemists in the war production of Canada was in part recognized, yet a great deal remained to be told. Through the publicity department of the Imperial Munitions Board, the Canadian Manufacturers' Association, the Engineering Institute and other bodies, the story of the engineer and the business man in our war work has been well put forward, but the story of the chemist is as yet largely untold. Then, again, while our steel and shell production was a marvel of organization and industry, we had before the war a fairly large number of skilled workers and plants which could be adapted to shell production. The explosive and chemical industries were in an entirely different position,—we had no skilled explosive workers or plants, or practically none.

The production of military explosives in Canada before the war was limited to the production of 3,000 lbs. a month of rifle cordite by the Canadian Explosives, Limited, and which was used by the Quebec Arsenal. We also produced a fairly large quantity of commercial explosives, somewhere in the neighborhood of 25,000,000 lbs. a year, and of these the black powder and nitroglycerine were both used respectively as a bursting charge for shrapnel and a constituent of cordite.

When the demand for explosives came to Canada in the autumn of 1914, steps were immediately taken to meet the requirements. By the beginning of 1915, the Beloeil plant of the Canadian Explosives, Limited, had been enlarged and was producing about 350,000 lbs. of cordite per month. By July, 1915, another cordite plant was put into operation at Nobel by the Canadian Explosives, Limited, giving us a total cordite production of about 1,500,000 lbs. a month. Two T.N.T. plants, one at Beloeil and one at Messrs. Curtis & Harvey's, at Dragon, also commenced operations about this date with a total capacity of 2,000,000 lbs. per month. A further increase in the supply of propellants from Canada was then demanded and two N.C. powder plants were erected, one by the Aetna Chemical Co., at Drummondville and one by the O'Briens Munitions, Ltd., at Renfrew. These had a capacity of about 1,800,000 lbs. per month. This introduced the manufacture of N.C. powder propellants into Canada for the first time and was the first N.C. powder made on a large scale in the British Empire.

In the latter part of 1916, a still further demand for explosives came to Canada. To meet the requirements, two national plants were erected, one at Nobel, the other at Trenton. These plants started producing about the middle of 1917. The output of Nobel was entirely cordite, while Trenton produced N.C. powder and T.N.T. This brought our total capacity to 2,500,000 lbs. per month of cordite. This represented our maximum output and a growth from 3,000 lbs per month to 3,000,000 lbs. per month of N.C. powder and 3,000,000 lbs. per month of T.N.T.

The position in regard to chemical and metallurgical products was similar. By 1918, we were producing acetic acid and acetone by a new process and on a large scale. We had enlarged our production of ethyl alcohol, ether, methyl alcohol, methyl-ethylketone, calcium acetate and produced for the first time in Canada, electrolytic zinc, magnesium, ferro-molybdenum and high-grade ferro-silicon, or, as it is sometimes called, silicon metal. We had also installed and were producing from by-products, coke ovens, benzol and toluol, the latter being used in the manufacture of T.N.T.

I doubt if even the average chemist appreciates the complexity of an explosive plant producing a single product like cordite or N.C. powder. Cordite, for example, consists of a colloidal mixture of guncotton and nitroglycerine or vaseline. The raw products are cotton, glycerine and vaseline, solvents, sodium nitrate and sulphuric acid. The cordite plant is really composed of six main plants, an acid line, a nitroglycerine line, a guncotton line, cordite line, solvent recoveries, ether stills and a powder plant. Any one of these lines is a large chemical manufacturing plant in itself. The acid lines consist of a large nitric acid plant with its retorts, coolers, towers and nitre-cake pans, an acid recovery system where the waste acid is treated and recovered and concentrated and there may or may not be a sulphuric acid plant as well. Two of our explosive plants in Canada had sulphuric acid chamber plants and consequent concentrating systems. The guncotton line has its own raw material, cotton, sulphuric and nitric acids. The guncotton is nitrated and then purified and delivered to the cordite line containing 30% to 35% of water. The purification is a long and thorough process taking about 50 hours of boiling, heating and washing. The nitroglycerine plant uses as raw products, glycerine, nitric and sulphuric acids, and as in the case of the guncotton line it is a process of nitrogen and purification and requires very great care and close control.

At the cordite lines the constituents vaseline, nitroglycerine and guncotton are brought together with the necessary solvents, mixed, pressed, stored, blended and packed.

The solvent stills have alcohol and acetone as "raw products" and separate the mixtures of acetone and alcohol as it is returned from the process. Then there is the power plant.

The Nobel national cordite plant cost about $3,000,000 and covered 366.84 acres with 155 buildings. This area was divided as follows:

Plant.		
Acid Recoveries	31	acres
Guncotton	54	"
Nitroglycerine	25	"
Cordite and solvent	236.84	"
Power and Safety	20	"

There were six miles of tramways.

The maximum monthly production was 1,767,000 lbs. valued at about 60c. per lb.

The Trenton plant cost about $5,000,000 and covered 250 acres with 204 buildings. There were seven miles of rails, 33,300 feet of water line, 20,000 feet of steam lines, 16,000 feet of acid lines, 10,000 feet of compressed air lines and 70,000 feet of electric wiring. There were employed 2,500 men and women in three 8-hour shifts. The boiler installation used entirely for process purposes was nearly 5,000

*(Address delivered at Convention of Chemists, Montreal, May, 1919.

h.p., and in addition 6,000 h.p. for power purposes was obtained from the Hydro-Electric Power Company.

The output per month of the plant consisted of:

8,000,000	lbs. of	66° Be	Sulphuric Acid
5,000,000	"	"	Nitric Acid
2,200,000	"		Pyrocotton
1,500,000	"		N.C. Powder
1,200,000	"		T.N.T.

The value of the monthly output was about $2,000,000.

It is unnecessary to tell this audience that these plants demanded close chemical control and a consequent large staff of chemists and chemical engineers. It is to the credit of our Canadian chemists that they were able to conceive, erect and operate these large plants and do so successfully.

Before the war, except for a small inspection organization existing at Quebec which inspected the output of the Quebec Arsenal, there was neither staff nor organization existing for the work of inspection. With the rapid growth of the munitions industry, there was an equally rapid growth of the inspection organization. This necessitated the getting together of the necessary staff and the training of that staff. The credit for this work and the success which attended the efforts of the inspection department is largely due to Col. Gordon Ogilvie, C.M.G., who, with the development of the separate inspection department, became the chief inspector and its mainstay, etc. From a staff of three or four men in 1914, inspecting a few thousand dollars' worth of material, the department grew until in 1918 the inspection staff consisted of 8,000 men and women and the value of the material inspected was about $50,000,000 monthly.

The inspection work was of necessity divided into a number of sections, each having its own organization. The material inspected ranged from aeroplanes to ferro-silicons and explosives to steel. One of these sections was explosives and chemicals, and it was with this section that I had the privilege of being associated.

When explosives first came forward from Beloeil for inspection, examiners were stationed at Beloeil whose duty it was to visually inspect the cordite and the finished package and to take representative samples. The chemical samples were forwarded to the laboratory of J. T. Donald & Co., in Montreal, where the required chemical tests were carried out and another sample of each lot was forwarded to the proof butts where the cordite was actually fired and ballistic results obtained.

With the advent of high explosives, chemists were placed at the plants producing H.F. to chemically inspect the output. With the formation of the Explosives Section, this arrangement was altered. Each of the large plants was constituted as a district, and at the head of each district was placed a chemist or chemical engineer who had complete charge of the inspection of the explosives produced in his district. A fully equipped laboratory was erected and all the chemical tests necessary were carried out in this laboratory. The ballistic tests had of necessity still to be carried out at the proof branches, two of which were put in operation, one at Quebec and one at Petawawa.

In 1918, the inspection of chemicals came under the explosives section, much enlarging our work, and by the middle of 1918 we had districts organized at Nobel, Trenton, Montreal, Toronto, Ottawa, and Trail, B.C. At Nobel and Trenton we had laboratories erected for us at the time the plants were constructed. In Montreal, through the courtesy of Dr. Ruttan, of McGill, arrangements were made to use some of the laboratory space in the Chemistry Building. In Ottawa, similar arrangements were made with the Director of Mines Branch, Dr. E. Haanel. In Toronto and Trail districts, laboratory facilities were afforded us at the various plants. By this time the materials we inspected were as follows: Cordite, N.C. Powder, Black Powder, T.N.T., Calcium Carbide, Methyl Alcohol, Acetone, Methyl-ethylketone, Formaldehyde, Calcium Acetate, Ferro-silicon, Magnesium, Copper, Zinc, Lead, Antimony. Particularly in the case of explosives the proper inspection of the finished material involved the inspection of raw products and intermediates, and this added such products as alcohol, acetone, cotton, ether, guncotton, etc.

Our work was divided into two main groups: First, explosives; secondly, chemicals and metals.

Explosives, again, very naturally divide into two groups, propellants including black powder, although it was not used as a propellant, and high explosive. As we only manufactured the one high explosive, when high explosive is referred to T.N.T. is meant.

Propellants.

The requirements for a satisfactory propellant are divided into two divisions:

Ballistic requirements,
Chemical requirements.

The ballistic requirements demand that the propellant, when delivered to the gun, shall fire the shell in an accurate and uniform manner. This means that a charge of propellant picked at random from a lot of 40,000 to 100,000 lbs. shall give exactly similar results to those produced by any other similar charge picked at random. This result is obtained by blending and by producing a material which has a uniform velocity of burning and is largely dependent on the physical measurement of the grains or sticks. Obviously a propellant firing long or short in an erratic manner is very dangerous and charges giving high pressures are likely to strain the gun.

The chemical requirements specify definite limits for the components of the explosive and for the raw and intermediate materials. They also prescribe definite stability tests. These tests are most important. It is the nature of an explosive to decompose fairly rapidly and the stability tests exist to make certain that this deterioration will not exceed a certain rate. If the stability of any part of a lot is unsatisfactory, there would be danger of the propellant decomposing in transit or on the dump at the front. The material would then be more dangerous to our own troops than to the enemy. Even if the deterioration had not reached this danger stage, very bad results might be obtained at the gun, although the ballistics were satisfactory at the time the material was manufactured. A further reason for laying great stress on stability is the danger of an unstable lot contaminating or infecting a number of normal lots, thus necessitating withdrawing all the lots from service. Ballistic and chemical requirements are so closely related as to be inseparable. Trouble in one inevitably leads to trouble in the other, directly or indirectly.

The two propellants dealt with in Canada—cordite and N.C. powder—differ in a number of ways. Cordite, the standard British service powder, has been used under all conditions and climates and has been found satisfactory. It is doubtful if the service powder of any other nation has been subjected to as severe climatic trials. Cordite consists

essentially of guncotton, nitroglycerine and vaseline in the proportions 65%, 30% and 5%. The mineral jelly or vaseline is added to decrease the temperature of explosion and also acts as a stabilizer. It is extremely inflammable and readily ignites from the smallest flame, spark or by overheating. It is not readily detonated when in the form of sticks. The cordite sticks must be smooth and straight to facilitate loading. They must be of uniform size and length. When held up to the light the cordite must be free from uncolloided cotton, air holes, and specks of foreign matter of any sort must be absent. When fired with the standard charge from a gun, definite velocities must be obtained, e.g., cordite from an 18 pr. must, when fired with the standard charge, give a velocity between 1,645-1,675 feet per second, a chamber pressure between 12 and 14 tons per square inch.

N.C. powder is the service powder of the United States. It consists essentially of a colloid of soluble pyrocotton. Diphenylamine to the extent of 0.4% is added as a sterilizer. The finished powder always contains an appreciable percentage of residual solvent about 3.5 inches for a 6 or 8-inch Howitzer size, and in this differs radically from cordite. It is also very hygroscopic. Then N.C. powder grains must be of uniform size and free from uncolloided cotton, air bubbles and foreign matter. The perforations in the grains must be symmetrical and of even size. Foreign matter of any sort must be absent. Discolored grains must not be present, as they frequently indicate incipient decomposition produced by careless work in manufacturing.

The inspection arrangements to cover the ballistic requirements consisted in obtaining ten 2-lb. samples from different parts of each lot and shipping these to the Proof Branch. In the case of N.C. powder, which is very hygroscopic, the samples were shipped in sealers. On arrival at the Proof Branch, these individual samples were made up into individual charges and five shots fired. At the same time these five shots were fired, five shots were fired with a standard propellant. The velocities of the different shots were taken by means of a Holden chronograph and the pressure in the chamber of the gun by means of pressure gauges. I cannot speak too highly of the work done by the Proof Branches at Quebec and Pettawawa. On several occasions when samples of the same lot were sent to both Proof Branches the average mean velocities agreed to within two or three feet per second on a velocity of about 1,660 feet per second. Our results also checked extremely well with the check results obtained at Woolwich Arsenal.

The inspection organization at the plant, with its chemical laboratory and staff of chemists and inspectors, endeavored to see that the quality of the finished materials was satisfactory. Raw products, such as cotton, were visually and chemically inspected. Stability tests were run on the guncotton and pyrocotton. In the case of the N.C. powder plants, an Abel heat test was run on every batch of pyrocotton. Occasionally tests were run on solvents, etc., and a general eye kept on the processes. Scrupulous cleanliness is essential to the successful manufacture of explosives, and when foreign matter appeared in the finished material it was, whenever possible, followed back to its origin. The finished lots were subjected to analysis and stability tests. In the case of cordite, the Abel heat test was the main stability test. In the case of N.C. powder the Methyl Violet test at 135° C. was used in conjunction with a surveillance test, really an accelerated keeping test. At a later date the small vessel test was introduced. This is a particularly interesting test. The finely ground N.C. powder is placed in a small flask fitted with a stop-cock. The whole is placed in an oven at a constant temperature and the loss of weight at intervals of 12 hours taken. When decomposition takes place, a marked loss in weight occurs, and if a curve is drawn a very sharp break is shown.

The physical measurements of the finished sticks and grains were also taken. In the case of 18 pr., cordite, which is without a perforation, the measurements are easily taken. In the case of N.C. powder, containing seven perforations, the measurements are much more difficult to obtain, and a microscope with a micrometer attachment is necessary.

It was pointed out earlier in the paper that ballistic chemical requirements were inseparably connected and the following is a very good example of this. N.C. powder has a certain percentage of residual solvents. These residual solvents exert a dampening effect on the ballistics. When a satisfactory design of grain has been adopted any slight variations in the given measurements which would change the ballistics are compensated for by slightly altering the residual solvents or moisture content. If, however, either the measurements of the grain or the residual solvent and moisture content fall outside certain limits, the ballistics can only be adjusted by blending with other lots. The blending area demanded a good deal of attention. A lot of N.C. powder of 100,000 lbs. or of cordite of 40,000 lbs. will contain about 25 batches of propellant, all varying more or less chemically and physically. The duty of the blending system is to so blend these lots that uniform ballistics are obtained. Owing to the shape of the N.C. powder grain, a small cylinder, blending can be done in huge towers or bins and a large quantity at a time. In the case of cordite, however, all the blending has to be done by hand and makes a very tedious process. When unsatisfactory ballistics were obtained from lots of propellants, it was usually traced back to poor blending, although this is not an invariable rule. The above is a brief outline of some of the points that had to be utilized on propellant inspection.

T.N.T. was being produced in Canada by two processes and purified by two processes. At the plant of Messrs. Curtis & Harvey, at Rigaud, the nitration was carried out in one stage. At the other plants the nitration was carried out in three stages. The T.N.T. coming from process, if proper precautions have been taken, will be a "Grade III." T.N.T. That is, a T.N.T. with a certain percentage of D.N.T. and insometric compounds as impurities.

The more impurities in T.N.T., such as D.N.T., the less sensitive is the explosive. In addition to the large demand for "Grade III.," which was used with ammonium nitrate to make amatol, largely used in the high explosive shells, there was also a demand for a higher grade known as "Grade II." with a setting point of not less than 79.5° C. This purer material is obtained from the "Grade III.," or crude, by recrystallizing from a solvent or by washing with an alkaline sodium sulphite solution. By recrystallizing from a solvent, such as benzol, or toluol, the D.N.T.'s are removed by washing with a sulphite solution. The T.N.T. isomers are removed. Both processes were used in Canada. From an inspection point of view, the sulphite process requires more careful watching as there is a danger of alkaline compounds being present which render the T.N.T. very sensitive.

The inspection of T.N.T. is largely confined to an inspection of the finished product. The setting point of the lots

are checked and acidity and alkalinity tests carried out, and also special tests for organic impurities which are liable to render the material unstable. Relative to propellant inspection, the T.N.T. inspection is very much more simple. No ballistic proof is carried out and the material is a definite chemical compound.

One feature of the inspection of explosive which has not been touched upon was the inspection of the finished packages. How important it was that satisfactory packages only should be sent out from the plant can be realized when the conditions of transport and the number of trans-shipments necessary before the explosives reached the loading factory are taken into consideration. The boxes must be sound, free from cracks and strongly built. In the case of N.C. powder, the boxes were lined with metal, and had to be air-tight. These containers had to be frequently checked to guard against air leakage which would change the moisture content and result in a change of ballistics.

In the case of T.N.T., which was shipped either as a flake or a powder, the packages had to be well lined with paper and sound, otherwise there was a danger of grains of T.N.T. passing through the cracks in the boxes with the consequent danger from loose explosive.

Chemicals and Metals.

The inspection of chemicals and metals provided many interesting features. The majority of the chemicals inspected were inflammable and special precautions had to be taken against leaky drums, etc. Some of the chemicals were extremely sensitive to contamination from outside sources, acetone, as used as a solvent for cordite, being particularly bad. Others of the chemicals, such as calcium carbide and silicon metal had to be packed in packages which were water-tight and in such a way that they were safe for ocean transport. The specification for the majority of these materials called for chemical analyses requiring great accuracy. As in the case of our explosive inspection, the great difficulty was the large quantity of material to be dealt with and which had to be handled expeditiously. Fortunately, the nature of the material made inspection easy. The output of the smelters at Trail was taken care of by a chemist who was stationed at Trail. The other metals, such as magnesium, were handled by the district inspectors.

Not the least of our troubles was silicon metal and ferro-silicon, which, owing to their explosive nature, were classed as chemicals. Each sample of ferro-silicon necessitated ten chemical determinations and anyone familiar with the analysis of ferro-silicon will realize the work entailed by these tests.

The Problems of Inspection.

The difficulties encountered by the inspection department were numerous. Inspection under ordinary peace conditions and dealing with peace products produced under normal conditions is difficult enough, but all of these difficulties are very much accentuated in dealing with war products. Inspection, as applied to munitions, differs from ordinary commercial inspection in that huge quantities are dealt with and very grave responsibilities rest upon the inspector. The material coming up for inspection must be inspected promptly and without delay. The inspector has certain specifications to which the products must conform. Certain clauses in these specifications must be rigidly adhered to; other clauses allow a certain amount of discretion in their interpretation. The inspector must always remember that his duty is to the troops, who will have to use the munitions, and insofar as explosives are concerned, his greatest concern is that they shall function properly when delivered to the front and be safe for the men who will use them. The manufacturer, on the other hand, is producing large quantities of material under great stress and is undoubtedly doing his utmost to turn out a satisfactory product. Some of the clauses in the specifications seem to him mere pitfalls imagined in the minds of Government officials solely for the purpose of creating greater difficulties in manufacture. He obviously dislikes having his product rejected. It means at least reworking and may mean rejection, either of which means loss of money. Rejection or rework also involves a cut in production and at certain stages of the war a cut in production was a very serious matter.

All of these points of view had to be taken into consideration by the inspector before his decisions were made. Then again there was the case of the manufacturer who, while producing the material within specification limits, could do better and should have been doing better. It was part of the duty of the inspection department to try to improve the quality of the product when such conditions existed. In other cases, information would be obtained from overseas of certain defects in our material, and steps would have to be taken to try to remedy these defects as rapidly as possible. Sometimes it was not possible to take the manufacturers into our confidence, and in such cases the position was much more difficult, as a manufacturer always likes to have a reason. The question has sometimes been raised as to the necessity for inspection. Would not the manufacturers produce the best article they were capable of manufacturing? The answer, of course, is that, no matter how good the intention of the manufacturer may be, his product may not be up to standard, and consequently may be more dangerous than useful. Then again the manufacturer, being human, is subject to mistakes, and it is part of the duty of the inspection department to try to eliminate such errors. From his point of view, the manufacturer is bound to be biased to a greater or lesser extent in favor of his own product, whereas the inspection department, seeing the production of a number of plants is in a better position to pass important judgment. It is not to the advantage of an inspector to reject material; it means trouble in all directions, and even the inspector is more apt to err on the side of the manufacturer. There is a very great temptation for the inspector to let small defects pass and avoid the consequent irritation to the manufacturer and responsibility for himself.

With these various considerations recognized, it was always the endeavor of the inspection department not to be dogmatic. When cases arose which produced conflicting opinions, we always endeavored to see the manufacturer's point of view and try to get him to see ours. When differences arose over chemical analysis or proof results, our attitude was always to believe we are right, but if you can show us where we are wrong, we'll be glad to rectify our mistakes. This resulted in our chemists and the manufacturers' chemists getting together with favorable results to both sides. There were, from time to time, cases where the inspection department had to insist on the acceptance of their tests. In such cases, we had such definite evidence in favor of our results that we felt safe in taking this attitude. As a check on our work, arrangements were made whereby the analyses of the manufacturers were supplied to us. In addition to this, we obtained regular

check figures on material shipped overseas from the inspecition staff in England. By thus having two checks on our figures, namely, the manufacturing plant here and the inspection department in England, we were able to get a close check on our chemical results.

Not the least of our troubles was the question of staff. The manufacturing companies at the beginning of our explosive activities had the only men in the country with an intimate knowledge of explosives manufacture. They were unwilling to part with these men and our staff had to be recruited from chemists familiar with other lines. On more than one occasion, when the manufacturers questioned the accuracy of inspection results, their attitude was that their knowledge of these materials was very much more extensive than ours, therefore, they must be right and we must be wrong. They failed to realize that well-trained chemists can easily adapt themselves to new lines of work with very little experience.

Conclusion.

Before closing, I would like to pay a tribute to the manufacturers for their willingness to co-operate with the inspection departments and the cordial relations that always existed. The inspection department was frequently helped and assisted by the manufacturers, and we endeavored to reciprocate wherever possible. Too much cannot be said for the superintendents and managers of these large plants, who wholeheartedly threw themselves into their work and worked to their utmost capacity for periods of three and four years. Their responsibilities were great and they worked under a great strain. Unless the results of a bad explosive fire or explosion have been seen, no conception can be entertained of the damage which can be done and the risks which were handled by the staff and employees of the large explosive plants.

I would also like to pay a tribute to the staff of the explosive and chemical section of the inspection department. For a period of three of four years, they worked to the limit of their capacities. It was always the misfortune of our section to be understaffed. This was due to the increasing quantity of work and the great difficulty in obtaining properly qualified chemists for our work. A number of the staff were men obtained from the army after they had enlisted, but before they had gone overseas. A number of others were extremely anxious to serve in the Army, but were held by the department, which refused to allow them to enlist. In all cases, they were paid very much smaller salaries than those paid by the manufacturing concerns for men of similar training, ability and experience.

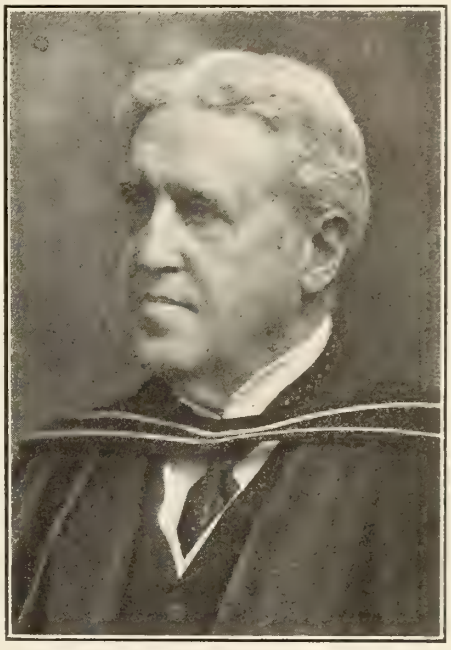
I would also like to acknowledge the courtesy of Mr. Murray, Chairman of the Explosives Committee, and Mr. P. B. Vancy, general superintendent, who were good enough to supply me with some of the data relative to the national plants.

DR. ROBERT F. RUTTAN, M.D. D.Sc., F.R.S.C.

Robert Fulford Ruttan, the son of Allan Ruttan, M.D., and Caroline Ruttan, was born on July 15th, 1856, in Newburgh, Ont. He prepared for Toronto University at the Napanee Collegiate Institute and graduated from the University of Toronto in 1881, obtaining the Gold Medal in natural sciences. He entered McGill and took the degree of M.D. C.M., obtaining the Gold Medal for chemistry in 1883. In 1885 he went to Germany and studied for two years in Berlin University under Professor A. W. Hofmann.

Dr. Ruttan became a member of the College of Physicians and Surgeons in 1884, but has never practised the profession of medicine.

He began his career in chemistry as assistant to Dr. Girdwood in the Medical Faculty of McGill University, holding the title of lecturer from 1887 to 1891, when he became Professor of Practical Chemistry and Registrar of the Medical Faculty, a position he held up to 1902. He then succeeded Dr. Girdwood as Professor of Chemistry in the Medical Faculty under the title of Professor of Organic and Biological Chemistry. In 1912 he was made director of chemistry for the whole university, holding the double title of MacDonald Professor of Chemistry Professor of Organic and Biological Chemistry. He has reorganized and consolidated the teaching of chemistry in the university which has generously supplied him with a large and efficient staff. He has taken special interest in developing graduate work and chemical



Dr. R. F. Ruttan.

research in his department and has a very live graduate school. The contributions to chemical literature from the department during recent years have been voluminous and important, particularly along the lines of organic, biological and physical chemistry.

He has represented the faculty of medicine on the corporation of the university continuously since 1891 and is a member of several of the important standing committees of the university.

In 1895 he was elected a Fellow of the Royal Society of Canada and has been twice president of Section 3, which is composed of mathematicians, chemists and physicists.

He was elected president of the Alumni Association of the McGill Medical Faculty in 1908 and has always been greatly interested in promoting closer relations between the graduates and the university.

The following paragraph was taken from the McGill Daily, and shows the student opinion of him in his professorial capacity:—

"The Doctor is a splendid disciplinarian, yet at times a

trifle severe, for he believes in having his students work. Woe unto him who enters Dr. Ruttan's department with the expectation of having an easy time. He shall be sorely disappointed.

"In his conversation the professor is very keen, brief and always to the point. He is very choice in the use of his words, and the occasional use of a gesture to force home a point either in conversation or lecture illustrates his strong mental capacities. He is very logical and graphic in his scientific exposition. The Professor is very industrious, skillful, but cautious; never does he arrive at a conclusion exsept by logical scientific reasoning.

"A few days ago the degree of D.Sc. was conferred on Dr. Ruttan by the University of Toronto. This is the highest honor which can be conferred by Toronto upon one of her most distinguished alumni."

He has always been interested in athletics. As a student he was a successful long-distance runner and played in many important cricket matches in Ontario. He was the first president in the McGill Cricket Club, which he established in 1883 and was a member of the Canadian Olympic Committee in 1908. He is a very keen golfer and has done much to develop the game in Canada. From 1903 to 1907 he was president and captain of the Royal Montreal Golf Club and was elected president of the Royal Canadian Golf Association in the latter year (1907).

His activities in the field of chemistry have been varied and extensive. He was one of the original members of the Canadian branch of the Society of Chemical Industry and was elected chairman in 1913. In 1914 he was elected vice-president of the parent society in England, a position which he still holds.

He was elected as one of the members of the Honorary Advisory Council for Scientific and Industrial Research in 1916 and is chairman of two of its most important committees, namely, the Committee on Assisted Researches and the Associate Committee on Chemistry. He has been very energetic in connection with the development of the utilization of the fish waste in Canada, in the modification of the patent law giving the members of the scientific staff of the Government the right to patent their inventions and discoveries, the introduction of duty free alcohol in Canada for industrial purposes and the publication of a census of the chemical industries of Canada by the Government. He acted as chairman of each of the special committees dealing with these questions.

Dr. Ruttan's research work has been almost entirely confined to organic and biological chemistry. His published papers include the Syntheses of some Artificial Alkaloids and other Organic Bases, including the chemistry of Ortho Tolidin, the Synthesis of Margaric Acid and the Physical Constants of Palmitic, Margaris and Stearic Acids.

His most recent contribution to the chemistry of fats has been to work out the composition and relations of adipocere. In these papers he has described the chemical mechanism by which all fossil fats, such as adipocere, bog butter, etc., pass into similar hard, waxy bodies, carrying a constant, but variable amount of two hydroxy stearic acids. He and his pupils have synthesized and described a number of fats from the glycols.

In addition to these more academic studies he has at various times investigated industrial and other general chemical problems. Some years ago he made a very complete chemical study of the waters of the Ottawa and St. Lawrence Rivers, also of the waters of several mineral springs, particularly the Caledonia waters. He was for many years consulting chemist to the Department of Railways and Canals for the Dominion Government. He has also taken prominent part in investigations connected with the action of sulphur dioxide on vegetation and has been called upon on several occasions to act as assessor to Canadian judges in cases involving chemical problems.

Dr. Ruttan is a member of a large number of chemical societies, including the American Association of Biological Chemists, and is a member of several social clubs, including the Chemists' Club, New York, Mount Royal Club and the University Club in Montreal. In 1917 he was elected president of the University Club, of which he was an original member and very active in its establishment. The latest honor bestowed upon him has been the presidency of the Royal Society of Canada for the coming year. His life has been a busy one and his interests varied.

SECOND ANNUAL CONVENTION OF CANADIAN CHEMISTS AND REGULAR ANNUAL MEETING OF THE SOCIETY OF CHEMICAL INDUSTRY.

(Concluded from page 178)

fineries; the Shawinigan Electro-Metals Co., showing magnesium and magnesium alloys.

Organization of the Institute.

Following the appointment of twenty-eight original members as a beginning, a meeting was held on May 21st in Ottawa, when a council of 15 were elected. The results of the election were:

President—Prof. J. Watson Bain, of the University of Toronto.

Vice-Presidents—Dr. George Baril, Laval University, Montreal; Dr. A. McGill, Chief Analyst, Department of Trade and Commerce, Ottawa; Dr. R. D. MacLaurin, University of Saskatchewan, Saskatoon, Sask.

Secretary-Treasurer—Harold J. Roast, F.I.C., Montreal.

Executive Members—Prof. E. G. R. Ardagh, University of Toronto; Dr. J. S. Bates, Kenogami, P.Q.; Dr. T. E. Bigelow, Mount Allison University, Sackville, N.B.; S. J. Cook, Department of Trade and Commerce, Ottawa; J. A. Dawson, Department of Trade and Commerce, Vancouver; I. Grageroff, Montreal, Que.; Dr. L. F. Goodwin, Queen's University, Kingston; Prof. A. Lehman, University of Alberta, Edmonton; Prof. E. MacKay, Dalhousie University, Halifax, N.S.; Prof. M. A. Parker, University of Manitoba, Winnipeg.

It was decided the fees for Fellows in the Institute should be an entrance fee of $10.00 and an annual fee of $5.00. For Associates, the entrance fee will be made $5.00 and the annual fee $2.50. The secretary announced the first subscription to the Foundation Fund of the Institute, namely, a cheque for five hundred ($500.00) dollars from the James Robertson Co., Ltd., Montreal. This announcement is most encouraging and is an indication that the industries are willing to encourage their chemists in breaking new ground for the betterment of their profession in Canada and the general advancement of science and industry.

The office of The Canadian Institute of Chemistry is in the Kingdom Building, Beaver Hall Hill, Montreal, Que.

Canadian Government Publications

By S. J. COOK, B.A., A.I.C., Public Analyst

Department of Trade and Commerce, Ottawa.

[NOTICE: Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, on application to the department of the Government issuing the same.]

Department of Agriculture.

Nitrate of Soda. A leaflet regarding nitrate of soda as a fertilizer, prepared for the information of the general public by the Division of Chemistry.

Seasonable Hints. Sixteen pages of "Hints" covering certain phases of farm practice for the months of March till June.

The Best Varieties of Grain. 8 pp. The Dominion Cerealist herein offers his suggestions as to the proper kinds of the various grains which should be planted in the different agricultural districts of Canada if the planter would follow an experienced, scientific worker in the seed world. Pamphlets such as this are seldom read by the people, who always want to know what the Government is doing for them.

Department of Mines.

Geological Survey.—Map. Publication No. 1704. Ainsworth, Kootenay District, B.C. The geology of this district, which lies to the west of Kootenay Lake, is shown on a scale of 2,000 ft. to 1 inch.

Map. Publication 1585. Mackenzie River Basin. Shows in outline the geology of the district comprising parts of British Columbia, Alberta and Saskatchewan north to the Arctic.

Map. Publication No. 1708. Bridge River, Lillooet District, B.C.

Map. Publication No. 1711. Colored diagram showing the geology along the route traversed by the Pacific Great Eastern Railway between Squamish and Lillooet, B.C.

Road Materials in the Vicinity of Regina, Sask. Memoir 107, No. 90 Geological Series. By L. Reinecke. 28 pp. 1 map, 2 plates, 3 figures. The heavy road traffic in and out of Regina, coupled with the fact that road building materials are scarce in this district, made it seem desirable that some work should be done here on this subject. The areas adjacent to the railway lines were investigated for a distance of about 25 miles out of the city, and one trip was made as far as Estevan, 115 miles away. The only materials found available were boulders, gravels and sands. The report deals with each of these in detail.

Department of Trade and Commerce.

Food and Drug Laboratory. Bulletin 423. Meat and Fish Products. 12 pp. 262 samples of canned meat and canned fish were examined in the laboratories of the Department, and a consolidated report of the work was prepared by Mr. O. G. Lye, B.A.Sc., of the Ottawa Laboratory. A review of the nutritive value of the various food constituents is followed by tables showing net weight, moisture, fat, protein and carbohydrate contents of the different foods which include salmon, haddies, tongue, herring, sardines, sausages, chicken, fish flakes, sandwich pastes, corned beef, tunas, mackerel, shrimps, roast beef, smoked beef, lobsters, oysters and clams. As a basis for judging the relative values, this bulletin is bound to meet a common need, and the task of the reader is made more easy by the fact that the nutritive value in calories per pound, as sold, is already worked out.

Bulletin 424. White Paints. 18 pp. The chief analyst points out in his introduction to this report that while it was at first intended that this should be only an inspection of market paint, the variety of composition found made it necessary that a study should be undertaken on this subject, particularly as such radical changes in usage have occurred in recent years. The report was prepared by Mr. S. J. Cook, of the Ottawa staff, under whose direction the work was carried on.

Ninety-three samples of white paint as it is sold on the Canadian market were analyzed and complete analyses of the pigment or solid portions were made and are reported in this bulletin. It is claimed that practically every brand that is sold in any quantity in Canada is represented and that this publication is the first complete report on the composition of white paints as they are sold on the Canadian market. In addition to the analyses which are reported in detail, there are tables giving the approximate composition of the pigments in trade terms in order that readers may more easily make comparisons between the various brands. The different pigments and fillers are discussed at length; notes on the methods of analysis are appended, and two definite recommendations are made: (1) That a uniform nomenclature for lead pigments be adopted in Canada; (2) that labelling such as will indicate the true composition of the paint be made compulsory. This bulletin has already enjoyed a wide circulation, and those who wish to procure a copy should ask for it at once.

Bulletin 426. Cream of Tartar. 5 pp. This is the eleventh bulletin issued by this branch on this subject since 1889. Of the 161 samples examined, four were found adulterated; 25 below 90% bitartrate, and 132 above 90%. It is recommended that a minimum limit of 90% bitartrate of potassium be established as legal.

Commercial Intelligence Branch.—Weekly Bulletins Nos. 795-798. No. 797 gives nearly three pages on the subject of Industrial Alcohol in Australia. The present production is said to be about 1,000,000 gallons, but it is pointed out that if it is possible to land spirit of 65 o.p. standard at 45 cents a gallon (in bond) at principal Australian ports, considerable business could be obtained. The quotation is from a special bulletin prepared by the Commonwealth Advisory Council of Science and Industry upon the proposals for the production of Power Alcohol in Australia.

No. 798 contains a list of explosives and chemicals at present in the hands of the Surplus Government Property Disposal Board of the United Kingdom. The quantities available and a brief description are given for each.

Dominion Bureau of Statistics.

Census of Industry. Part IV., Pulp and Paper, 1917 50 pp. Bilingual.

In two years Canada's pulp and paper industry has grown nearly 140%. In 1917, there were 83 mills in operation and the value of their products was $96,340,327. Statistics relative to the industry are given in detail in this recent publication of the Bureau of Statistics in very readable form. Following the introduction and summary, there are 26 tables covering production, raw materials, capital, equipment,

power employed, employees, salaries, wages, working time, expenses, and imports and exports in every way that any reader is likely to want the information.

Monthly Report of the Trade of Canada. February, 1919. 365 pp.

The section devoted to "Drugs, Dyes, Chemicals and Medicines" has much of interest to the chemist. The variations in our importations are quite notable this year, particularly when compared with the war-years. There are still quite a number of items at which the thoughtful chemist looks twice. When importations run from half a million dollars a year up, one is compelled to wonder if there is not an opportunity there for the Canadian. It is not supposed that new business should be established upon a casual discovery of such an occurrence, but when imports grow in items that we could make, some move ought to be made. Perhaps if manufacturers had more confidence in blue-books and looked upon the compilers of them as human beings with very often a real desire to help actuating them, there would be more co-operation and team work, and possibly more progress.

Monthly Bulletin of Agricultural Statistics. February, 1919.

Average prices of farm produce, crop reports from the various provinces and from other countries, as well as from the Experimental Farms and Stations, the weather, and shipments of grain fill this little monthly with much useful information of general value.

Monthly Bulletin of Agricultural Statistics. March, 1919. (See above.)

Annual Report on the Trade of Canada for the Fiscal Year Ending March 31st, 1918. 1,052 pp.

The publication is divided into three parts: (1) Summary Tables; (2) Analysis of Current Trends; (3) Detailed Tables. The first section is historical and our imports for consumption and exports are there given by provinces for the years 1850-1918. The trade of Canada, with all countries is also summarized for the same period, and following are tables showing our trade with the United Kingdom and the United States for the same years. Total Canadian exports and exports of Canadian-made goods are similarily reviewed.

The second section comprises tables showing exports, imports and duty collected at customs ports for the year 1917-1918. Imports and exports by months and by countries and our aggregate trade by countries are tabulated; the movement of bullion by countries is given; and imports and duty collected under the general, preferential and treaty tariffs and summed up for the years 1915-1918 inclusive.

The last part deals with our imports and exports by articles for the last fiscal year, together with tables showing the imports for the period 1914-1918, the imports under the British preferential tariff for the year 1918 and also under the French treaty rates. The volume concludes with a summary of exports of Canadian goods and also foreign goods exported via Canada during the year.

REPORT OF THE CONVENTION OF THE A.L.C.A.

The American Leather Chemists' Association held their annual convention at the Marlborough-Blenheim Hotel at Atlantic City, May 22nd, 23rd and 24th.

The sessions were largely attended, there being present upward of one hundred leather chemists and others connected with the allied industries. A number of valuable papers were presented, and the discussion following the reading of the papers was very interesting.

The president of the association, Mr. R. W. Griffith, of Canton, N.C., made the opening address in which he called attention to the past work of the association and the services rendered by the members of the association during the war.

Committee reports were presented by chairmen of the various committees on various methods of analysis, and special mention might be made of the report made by Mr. Churchill on the determination of sulphuric acid in leather. This is an unusually important determination, and has been an enigma to tannery chemists for many years. The committee found that by a slight modification of the original Proctor-Searle method, quite reliable results are obtained. It might be mentioned that Mr. Churchill is the managing director of the new American Leather Research Laboratory which was established by the tanners of the United States a little over a year ago.

Mr. Van. A. Wallin, who was the very efficient president of the Tanners' Council during the war, was unable to be present on account of illness b,ut sent in a paper on "Tannery By-products." He called attention to the utilization particularly of cattle hair removed in the preliminary tanning operation, showing that the difference between cattle hair and wool is largely a matter of cellular structure.

A very good article was also presented by J. A. Wilson, of Milwaukee, on "The Application of Colloid Chemistry to the Leather Industry." Mr. Wilson has been foremost in the study of the theory of tanning, and his paper was a masterful compendium of our theoretical knowledge on this subject. Dr. Gerrard, of Columbia University, took an active part in the discussion and explained many of the general principles of colloid chemistry.

Mr. C. R. Delaney presented a statement on natural American dyes, and called forcible attention to the fact that whereas the newspapers, magazines, etc., have been devoting enormous space to the establishment of an American dye industry, the facts are that the natural dye-stuff industry was established well over one hundred years ago. Furthermore, that these natural dyestuffs, such as extract of logwood, fustic quercitron, sumac, etc., were of very considerable importance, and of great financial value before the war. He also showed that these natural dyestuffs are equal to, and superior in some cases, to the artificial dyes, and that the slight decrease in the use of these products in the five years before the beginning of the war was due to the introduction of the German selling method of "seeing the dyer."

Other committee reports were rendered on determination of ash in tanning liquors, also on determination of sulphite-cellulose in extract, and practical uses of niter cake.

Dr. Allen Rogers, of Pratt Institute, read a paper on "The Tanning of Shark and Porpoise Skins," and exhibited samples of leather tanned from these skins, also samples of oil, stearine and fertilizer prepared from the bodies of the fish. Dr. Rogers has made a study of the possibilities of this industry and one concern it at present tanning these skins.

Further interesting papers read were on "The Absorption of Chromium by Hide Powder," By Mabel E. Baldwin, of Columbia University; "Sulphonated Oil," by Dr. C. G. Bumcke, and a very interesting report, illustrated with

motion pictures, was given by a representative of the Forest Products Laboratory.

A committee report concluding three years' work on the effect of hard water on tannin, was given by T. A. Faust, of London, Canada, in which it was established that whereas it was not possible to definitely prove a destruction of tannin by ordinary laboratory experiments, it was conclusively proved that in practice, hard water does cause a loss of available tannin.

There was also considerable discussion on the extraction of oils and greases from leather, and it was definitely established that petroleum ether is not an efficient solvent for this purpose, and that chloroform is much preferable although open to some objection.

A resolution of sympathy was passed in memory of the late Mr. W. A. Fox, former associate editor of the A.L.C.A. Journal, and a past member of the Council.

At the election of officers Mr. F. H. Small, of Worcester, Mass., and Mr. J. C. Churchill, of Research Laboratory, were elected members of the Council for the coming two years.

TEACHING CHEMISTRY BY MOTION PICTURES.

By Arthur C. Neish.

THERE has been considerable discussion regarding the proper method of training the chemists in our educational institutions so that they may be able to fully comprehend the commercial aspects of their learning. The inability of our average graduate to apply his knowledge in the plant is the almost unanimous criticism coming from the chief chemists of our leading chemical industries.

It is proposed to partially overcome this deficiency by inducing the industrial managers to co-operate with the educational institutions in the vicinity of their plants so that students may be permitted to spend part of their time in those plants.

It is readily seen that this method can only partially solve the difficulty, for most of our educational institutions are not conveniently located near industrial centres, and it is not good educational practice to have a student specialize in any particular industry during his course of training. Also, there is a certain amount of inconvenience to be endured by the manufacturer, which he is not always willing to do.

It seems, then, that the solution lies only in bringing the plant to the student. This may be done very readily and simply through the medium of the motion picture. In this way, all our chemical industries may be brought to all of our educational institutions, however situated and however small. How can this be done so that the films may possess actual technical value and be an accurate and truthful representation of the industry shown?

There are certain attributes that all such films must possess. (1) The film must be specially prepared for the purpose, and with a full recognition of the educational requirements. They must comply with the fundamental requirements that, where industrial operations are shown, the whole of the process shall be displayed in a manner that will make clear to the student the exact nature of the technical operation.

This is a condition that has hitherto been very difficult to meet. Now, however, we have a means of showing all processes and operations that do not permit of and are not readily shown by direct photography, by the method of animated drawings. In this way the reactions that take place inside the vessel, the principles of operation, and, in fact, any obscure features of the process, can be shown in such an illuminating manner that even the dullest minds cannot help but understand.

(2) The pictures must be supplemented by a technical description, given by a person expert in the subject that is being illustrated.

Realizing the importance of this field of the educational work, the Community Motion Picture Bureau, a motion picture corporation dealing exclusively with educational films, has added to its staff of experts, men who are expert in the field of chemical industry, both from the viewpoint of the educationalist as well as the industrial manager. In this way all films will be accurately planned, produced and presented in such a way that there can be no question or doubt as to its educational value. Each film will be thoroughly viewed and approved by the chief chemist or other representative of the plant which it depicts and a booklet containing a description or scenario will be prepared, explaining in detail all of the chemical reactions and operations taking place.

(3) The film must be shown under conditions that will enable it to be stopped when required, so that where the subject calls for a fuller explanation, this can be given.

There is now available a small standard portable projector which is particularly suitable for lecture table and class room work. This machine can be stopped at any point and the picture held virtually as a lantern slide without danger to the film, while the instructor explains in more detail the student's query. Not only this, but if for any reason the student wishes any particular point to be shown again, the film can be automatically run backward to the point in question and then re-run.

An effort is being made to have a complete library of films ready for the schools by the opening of their fall semesters. All that remains now is the hearty co-operation of the manufacturers in having their processes filmed. By so doing, they will not only serve the whole industry by educating its chemists, their future employees, but they will derive the benefit of the best form of advertising possible, that advertising which reaches the real consumer, who will know what he wants and where he can best get it. Aside from this, they will be instrumental in stimulating an increased interest in the chemical industries.

Columbia University,
New York City.

MODERN THEORIES ON DIFFERENT METHODS OF TANNING.

The tanning of dermic tissues by vegetable tannins may be considered as the result of the following phenomena, which occur simultaneously:—

1. Chemical reaction with the quinonic compounds in the tanning liquors.
2. Phenomena of adsorption or pseudo-adsorption resulting in the precipitation of the colloidal tannin, either by the gel constituting the swollen dermic fibres, or as a result of the concentration of the solution at the surface of the fibrillose tissues, according to Gibb's rule.
3. Transformation of the precipitated tannin from the reversible form to the insoluble irreversible form, both through chemical actions (oxidation, hydration or polymerization), and through penetration into the

dermic gel of the tannic gel precipitated on the surface.

4. Osmotic action resulting in the dehydration of the swollen fibre and in the formation of a more and more pronounced fibrillose structure.

Tanning by fish oils seems to be due to the presence in these oils of free fatty acids containing four ethylene linkings, of which at least two can be saturated by absorption of oxygen giving rise to bi-peroxides.

1. Part of the bi-peroxide acids react with the proteid matter, one of the peroxide groups attacking the nitrogen groups, which are oxidized by elimination of hydrogen; the hydrogen thus liberated transforming the oxygen of the second peroxide group into two hydroxyl groups; finally one of these hydroxyl groups lactonises the carboxyl of the fatty acid.
2. Another portion of the peroxide acids undergoes a molecular transposition, which gives rise to hydroxyl groups, which in turn form lactones with the carboxyl groups. These lactones are retained by the fibres, presumably because they are unaffected by the subsequent alkaline washings.

In the process of tanning by formaldehyde in the presence of alkaline carbonates, there are two distinct actions:

1. Osmotic dehydration produced by the saline solution, resulting in the isolation of the fibres one from another.
2. Tanning action, properly so-called, due to the formaldehyde, which fixes the fibres and decreases their sensitiveness to the action of water. This latter seems to be due to a reaction taking place at the nitrogen groups, according to one of the equations:

$$(R — NH_2) + HCHO \quad R — N = CH_2 + H_2O$$

$$2\ (R — NH_2) + HCHO \quad \frac{R — NH}{R — NH} \quad CH_2 + H_2O$$

Highly interesting, but rather complicated, theories are brought forward to explain the action of chrome tanning.

"Synthetic tannins" are condensation products of phenols with formaldehyde. Their action is due to the free sulphonic and free hydroxyl groups, i.e., they are absorbed owing to their acid character.—Louis Meunier, Chimie & Industrie, I., Nos. 1 and 3, June and Aug., 1918.

PERSONALS.

Mr. J. R. Macaulay, B.Sc., has joined the staff of J. T. Donald & Co., and will be connected with their Montreal office. Mr. Macaulay for the last three years has been connected with the explosives inspection section of the Imperial Ministry of Munitions, being located successively at Rigaud, Trenton and Ottawa. Before joining the Imperial Ministry of Munitions, Mr. Macaulay was chief Chemist at Plant No. 1 of the Canada Cement Co., Montreal. Mr. Macaulay will specialize in cement, ceramics, road materials, etc.

Mr. Geo. D. McIntyre, recently with the Canadian Explosives, Ltd., Montreal, is now with Hugh Russell & Sons, Limited, of Montreal, in charge of their new chemical department.

Mr. G. O. Morrison, formerly chief metallurgist for the Brown Copper and Brass Works, New Toronto, Ont., has accepted a position with the Shawinigan Water and Power Co. at Shawinigan Falls, Que. He will carry on research work in connection with the manufacture and casting of magnesium alloys.

Mr. A. P. Couture, chemist with the Riordon Pulp and Paper Co., Merriton, Ont., has taken a position with the Dominion Government and will be at the laboratories of the Department of Trade and Commerce, Halifax, N.S.

Capt. F. G. Sterne, who during the war period was engaged at Trenton, Ont., in charge of laboratory and plant work for the Imperial Munitions Board, is leaving for England. He will be engaged as technical expert in the English sales offices of the Shawinigan Water and Power Co., Montreal.

Mr. Gorman, formerly with the Mead Paper Company, of Chillicotte, Ohio, has been appointed chemist at the Howard Smith mill at Beauharmois.

Mr. Leon A. Nix, a graduate of the Syracuse Forestry School, and recently with the Chemical Division of the United States army at Baltimore, has been made assistant forester of the St. Maurice Paper Co.

Mr. Frank J. Tone has been elected president of the Carborundum Company, of Niagara Falls, succeeding the late Frank W. Haskell. George R. Rayner has been elected vice-president, succeeding R. B. Mellon, of Pittsburgh. F. H. Manley retains the office of treasurer.

OBITUARY

Thomas Howard Young, 1883-1919.

Thomas Howard Young was born in Birmingham, England, his father being a professor of science in that city. On coming to Canada, Mr. Young was appointed Chief Chemist of the Canadian Pacific Railway at Winnipeg. Early in the period of the war, he moved to British Columbia as consulting chemist with G. S. Eldridge Company, finally acting as Government Inspector of Explosives at the James Island trinitroluol works of the Canadian Explosives, Limited. In this work, his health became seriously affected, and last fall, with his wife and young son, he removed to Glendora, California. He was unable to recuperate, and after a few months' illness, passed away in the prime of life.

His was a noble and courageous spirit, whose ruling love was music and science, and whose patriotism to chemistry and democracy entitles him to a memorial with those who made the supreme sacrifice on the field of battle. His friends in Canadian chemistry mourn his loss, and their sympathy and condolence is extended to his family and relatives in England.

INDUSTRIAL SECTION

Alberta.

Calgary.—The Coca-Cola Company will expend $70,000 on its new plant on Fourth Avenue W. Operations will commence soon.

The Alberta Flour Mills have taken out a building permit for erection of mill costing about $550,000.

British Columbia.

Vancouver.—A million-dollar factory is to be built in Vancouver, B.C., by the Coca-Cola Company, at the corner of Richards and Smyth Streets. One story is to be erected at present and provision made for the addition of two stories later.

The Vancouver Portland Cement Co., Ltd., it is understood, is amalgamating with the Associated Cement Company (Canada), Limited, which is backed by English interests, and the consolidated concerns will carry on business under the name of "British Columbia Cement Company, Limited."

Plans are in progress for ice plant and cold storage, costing $5,000, for Vancouver Ice & Cold Storage Co., Gore St.

A building permit has been taken out by the Liquide Air Society, 1 Ernest St., Maisonneauve, with headquarters at Montreal, for erection of a branch factory, the first unit of which will cost $25,000.

Vernon.—Dominion Canners, Limited, are re-building office building recently destroyed by fire.

Manitoba.

Brandon.—The Coca-Cola Co. have started work on a $21,000 factory building.

Winnipeg.—The Imperial Oil Co. are proceeding with the erection of their tankage stations throughout the West, putting 85,000-gallon tanks at some points and setting up distributing centres where tanks holding from 500,000 to 1,000,000 gallons will be erected. Further work in prospecting for oil fields will also be carried out.

Upon the death of E. H. Bissett, president of Bissett & Webb, Ltd., who controlled the stock in the Owl Metal Co., Ltd., Winnipeg, the estate sold his interest to E. G. and L. R. Barrett, of the Vulcan Iron Works, Winnipeg. The firm are now erecting an addition to their present factory. They intend to recover metals from scrap and metal by-products, converting brass and bronze filings, turnings, borings, into ingots after refining. Their white metal department for the manufacture of solders for tinsmiths and plumbers, and machine type metals for newspapers and printers, is also being largely extended.

NEW BRUNSWICK.

Moncton.—J. A. Humphry & Son, Limited, are erecting two brick factory buildings.

NOVA SCOTIA.

Sydney Mines.—Repairs are about completed to the furnaces of the Nova Scotia Steel & Coal Co. Operation of one rolling mill was resumed recently and the other mills are to recommence work within a few days. Plans for a complete reorganization of the company's plant are being worked out and a statement of development is expected within a few weeks.

Sydney.—The Dominion Steel Corporation is making progress in the extensions on the plant which have been planned for and which have been found necessary to meet the demand for their products and to meet the demand for labor employment. Work on the construction of the new power house has been started by the Foundation Company. The new power house will be built just north of the blast furnace boiler house, where there is plenty of room for enlargements. The second battery of coke ovens, which were under construction by the By-Products Co., are being made ready for the first bank. This marks the completion of two years' work by the By-Products people, the first bank of sixty ovens having been opened last year. Wabena, the Steel Company's source of ore supply in this country, is to have a new power house also. The mine at Wabena has always been electrically operated and the new power house means the extension of the work there. There will be a large power house, with two generators of 2,000 kw.'s each and three sub-stations for the lower voltage. The construction on this has already started.

Ontario.

Brantford.—Incorporation papers have been granted to Bayard Geekie Cobb, of the City of New York, engineer; W. J. Aikens, Dunnville, manufacturer; J. B. Detwiler, manufacturer; Thomas Hendry, insurance broker, and W. T. Henderson, King's Counsel, all of the City of Brantford, to acquire, erect, construct and operate furnaces for smelting and reduction of ores, metals and minerals, etc. The firm will operate under the name of "Electro Tin Products, Limited." Capital is $300,000.

Bancroft.—An expenditure of $500,000 is contemplated by the Canada Marble Co., 18 Toronto Street, Toronto, for machinery and plant equipment in connection with development of marble quarries.

Fort William.—Pipe foundry of Canadian Iron Corporation will be remodelled at a cost of $125,000.

Galt.—The Galt Art Metal Company, Ltd., plan the resumption of business on a pre-war scale and the employment of additional hands.

Guelph.—The Guelph Worsted & Spinning Co. propose to erect a one-story addition to their plant at a cost of about $20,000.

An extension is to be made to the plant of the Sterling Rubber Co., Ltd., at a cost of approximately $10,000.

Hamilton.—A company has been formed here, largely of local capital, to be known as the Empire Meter Co. for the manufacturing of a gas meter that has, it is said, 34 less parts than any other.

Haileybury.—The United Iron and Machine Co., Ltd., will erect foundry and machine shop.

Collingwood.—The plant of the Imperial Steel & Wire Company was totally destroyed by fire on May 25th. The plant but recently closed down for overhauling, prior to resuming operations on May 27th, several cars of raw ma-

terial being on hand for this purpose. Loss, probably, $200,000. Colonel J. A. Currie, M.P., is president.

Larder Lake.—The Associated Gold Fields of Larder Lake will erect a mill to cost $600,000, including a cyanide plant.

Meaford.—A company has been formed here composed of 50 business men of the town for the developing of certain oil lands in the township of St. Vincent, about 1,000 acres in extent. Recent tests resulted in a strong oil flow.

The Empire Meter Co. will commence operations at 134 North Bay Street within a short time. It will manufacture gas meters. The company has taken a year's lease of the premises and will erect a new building during the year. The product is a meter invented by S. J. Pocock, of this city, and requires, it is claimed, 34 fewer parts than any other meter on the market.

The Barton Electric Co., which is occupying half of the building vacated by the Canadian Carborundum Co., East Barton Street, will manufacture electrical appliances.

Mimico.—Alterations and addition to plant are planned by the Ontario Sewer Pipe Co.

Port Arthur.—Work will shortly be started on the Carrick pulp mill. It will be built in 50-ton units, other units to be added as business warrants until the maximum capacity of 350 tons is reached.

Port Hope.—T. B. Chalk and J. R. Kennedy have leased the milling property on Barrett Street, now owned by the G.T.R., and will enter into the business of manufacturing veneer. The new company will be known as the Port Hope Veneer & Lumber Co.

St. Catharines.—Plant of Whitman and Barnes will be completed this spring.

Sarnia.—The Holmes Foundry Co. is contemplating the erection of fifteen houses on its property at the north end of the city. The company will commence shortly on the construction of a plant and the houses will be built near their factory.

Sault Ste. Marie.—When he endeavored to assist a fellow-workman who had got into difficulties in a benzol tank at the plant of the Toronto Chemical Co., Lionel Beckett was overcome by fumes and expired before he could be brought to the top of the tank.

Toronto.—The Toronto Structural Steel Company has accepted an offer of $150,000 for its land and buildings, with certain fixtures. The Ontario Investments, Limited, is taking over the remaining assets of the concern for $165,000 in cash and assumption of all liabilities. The Structural Steel Co. has not paid preferred dividends since June, 1914.

Plans are being prepared for a one-story reinforced conplant for the Canadian Ice Machine Co., Limited, 82 Chestnut Street.

Savoy Candy Co., Limited, 362 Bathurst Street, are erecting an $8,000 addition to their factory.

Robertson Bros., Limited, 103 Queen Street East, will shortly start the erection of a 5-story factory at a cost of $60,000.

Willards Chocolates, Limited, are erecting a $90,000 warehouse adjoining their factory on Wellington Street West.

The Moyes Chemical Co. have made an assignment during the past month.

Seaman Kent Co., Ltd., 263 Wallace Ave., plan establishing manufacturing plant.

Tenders are open for excavating (trench work only), concrete and brick work for $15,000 three-story mill and brick factory for Dominion Electric Switch Box Co., 10 Croft Street.

Walkerton.—Plans are in progress to convert the saddlery factory into an up-to-date manufactory of iron and steel goods. Frank L. Clark, Woodstock; C. C. Larson, engineer, Woodstock.

Walkerville.—The General Motors Co. will spend $6,000,000 within the next eighteen months in extensions and new construction work.

Waterloo.—The Charles Mueller Company, Limited, have let contracts for the erection of additional dry kilns, costing approximately $5,000.

Windsor.—B. H. Marsh will erect a candy factory this year at a cost of about $40,000.

A building permit has been taken out by the Kelsey Wheel Co. for addition to plant costing $15,000.

The International Castings Co., Ltd., is completing a modern casting foundry at the corner of Chippewa and Back Streets, which will cost about $50,000.

Wingham.—Aero Cushion Inner Tire Co. plans erection of factory.

The Seagrave Fire-fighting Appliance Co. expects to establish a big motor industry somewhere in Western Ontario. The Wingham Board of Trade hope to secure the industry for this town.

QUEBEC.

Montreal.—Work has commenced on the erection of a two-storey brick factory for the Barrett Co., Limited, 2021 St. Hubert Street.

The Dominion Bridge Co. have awarded the steel contract for the factory extension of La Reina Mineral and Soda Water Co., Ltd., Duverney Street.

The Montreal Portland Cement Company, formed of British and Belgian capital, have purchased a site of 54 acres at Pointe-Aux-Trembles for $40,000, and work will soon begin on new cement plant to cost $250,000, and eventually turn out 4,500 barrels a day. The company has received exemption from taxation and free water for twenty years from municipalities at Trenton. President Robert Dodd said no stock will be issued in Canada. The company will be producing 500 barrels daily by September.

The Shawinigan Water & Power Company announce that they will shortly open offices in London, England, for the purpose of further developing the sale of the products of the various subsidiary companies allied with the Shawinigan interests. The company state that a large market exists in Great Britain and Western Europe for the products of the Canada Carbide Company, and for the output of the Canadian Electro Products Company, who manufacture acetic acid, acetaldehyde, and a number of other chemicals related to acetic acid. The London office will be under the direction of Mr. H. T. Meldrum, who was connected with the Canadian Manufacturers' Association's offices in Montreal for several years, and during the war served in England as the War Purchasing Agent of the Canadian Pacific Railway. Associated with Mr. Meldrum will be Captain E. T. Sterne, a chemical engineer of high standing. For the past two years he was in charge of the chemical works of the Imperial Munitions Board at Trenton, Ont.

The Scottish Canadian Magnesite Company, Limited, has been incorporated with a capital of $1,000,000 and head office in the city of Montreal.

Hugh Russell & Sons, Limited, of Montreal, who have been in the iron and steel business since 1868, are now entering the chemical field. This move is based on the

faith that the future of the chemical industries of Canada is now assured. Heavy chemicals will constitute the initial effort of this new branch and it is understood that arrangements have been made with one of the largest English exporters of chemicals. Mr. George D. McIntyre will be in charge of this branch of the Hugh Russell Co.

Sherbrooke.—The MacKinnon Steel Co., Limited, have just taken a contract for the supply of all necessary steel work in connection with eight-story apartment house being erected on Drummond Street, Montreal, by P. R. DuTremblay. The name of the general contractor is Alex. MacKay, Montreal. The valuation of the complete structure is five hundred thousand dollars and the steel work will amount to approximately sixty thousand dollars.

United States.

Texas.—Another sulphur deposit has been discovered in Texas, in Matagorda County, between Bay City and the Gulf, about 30 miles west of Freeport. It will be operated by the Texas Gulf sulphur Co., The sulphur will be mined by the superheated steam forced down to the deposit from a 10,000 h.p. boiler plant.

Foreign.

Germany.—The chemical industry is suffering from lack of raw material. In the Lubeck district, it is feared that the sulphuric acid and superphosphate industries will be compelled to close down, due to the shortage of raw materials. Only the resumption of imports from North America and Northern Algeria will aid these industries. There are no phosphates for the manufacture of fertilizers at Potsdam. Supplies of coal are inadequate in the hydrochloric acid works. From Gera, however, it is reported that the demand for fertilizing lime is exceptionally brisk, and that the works there are provided with orders for the next six months.

THE FIFTH EXPOSITION OF CHEMICAL INDUSTRIES.

The Fifth Annual National Exposition of Chemical Industries will this year be held in Chicago at the Coliseum and First Regiment Armory during the week of September 22nd, and, as usual, there will be a number of society meetings held jointly with it. It is an encouraging sign that the American Institute of Mining Engineers is among the number. We hope that this contact between the mining engineers with things chemical, chemists and chemical engineers will be to their increasing and mutual advantage We know there is much that the mining engineers may gain from the Chemical Exposition, and, without doubt, they will leave behind something of value.

The movement to Chicago was decided unanimously last September at a meeting of the Advisory Committee of the Exposition with the managers of the Exposition for two reasons: The U.S. Army commandeered the Grand Central Palace Exposition Building immediately upon the close of the last exposition, to be converted into a receiving hospital, the use for which has now, happily, nearly ceased; the Chicago Section of the American Chemical Society had been active in their interest in the Exposition, and were keenly interested in having it given in the city of Chicago; the Association of Commerce felt a keen interest in welcoming the Exposition, and it was one thought that the Exposition would succeed in bringing about a greater development along lines of chemical industries in the Chicago district and the near adjoining states.

The Advisory Committee of the Exposition consists of: Charles H. Herty (Chairman), Editor, "Journal of Industries and Engineering Chemistry;" Raymond F. Bacon, Director, Mellon Institute; L. H. Baekeland, Member Naval Consulting Board; W. D. Bancroft, President, American Electrochemical Society; Henry B. Faber, Industrial Filtration Corp.; Ellwood Hendrick, President, The Chemists' Club; Bernard C. Hesse, Chemist, General Chemical Co.; A. D. Little, President, Arthur D. Little, Inc.; Wm. H. Nichols, President, American Chemical Society; R. P. Perry, Vice-President, The Barrett Company; H. C. Parmelee, Editor, "Chemical and Metallurgical Engineering;" G. W. Thompson, President, American Institute of Chemical Engineers; T. B. Wagner, Vice-President, U.S. Food Products Corp.; M. C. Whitaker, President, U.S. Industrial Chemical Co.; and Charles F. Roth and Fred W. Payne. There is also added a special Chicago committee, consisting of L. V. Redman, W. D. Richardson, A. V. H. Mory, Carl S. Minor, F. W. Willard and Wm. Hoskins; the managers, as in the past, are Charles F. Roth and Fred W. Payne, and the general office is at 417 South Dearborn St., Chicago, Ill.

When first the move to Chicago was planned, it was decided to use the largest available exposition building there, the Coliseum, which is conveniently located for the business, hotel, residence and industrial centre of the city. It soon developed that the space in the building was inadequate and shortly after the signing of the armistice, when Government property formerly excluded from entree of the public, was again opened, the management made arrangements to engage the First Regiment Armory for exhibits and meetings of some of the societies. The Armory faces the next parallel street, which is Michigan Boulevard, and is divided from the Coliseum only by a narrow alleyway, across which visitors will step from exhibit to exhibit. The managers report that considerable of this space is already engaged, and that from present appearances, the companies engaging space therein being Chicago concerns, will make a creditable showing for Chicago industrial progressives.

Speaking of the number of exhibitors, they say that there are already a larger number than at a similar period last year with many new companies who had not formerly exhibited. There are also the names of regular exhibitors, which have become inseparably connected with the Exposition and which have become established as the bulwark of the American Chemical Industry or supplying the chemical industries.

Of the meetings to be held in connection with the Exposition, a splendid program is in preparation, which includes the general meetings of the American Electrochemical Society, the American Institute of Mining Engineers and the American Ceramic Society; the Technical Association of Pulp & Paper Industry is planning to meet with the Exposition in several technical sessions. The Chicago Section of the American Chemical Society will have headquarters at the Exposition where it is likely a meeting will be held. There is already an indication that these meetings will be interesting ones; the Mining Institute is arranging a session upon a pyrometry symposium, which will consider several phases each of: Methods of Pyrometry, Industrial Pyrometry, Pyrometry and Its Relation to Science. Special stress will also be laid upon the iron and steel industry by the Institute. The American Electrochemical Society is planning an interesting program, so, too, is the Ceramic Society.

There will be in Chicago during the week no other conventions than those invited by the Exposition; by this there

is assured adequate hotel accommodation for the thousands of visitors who will go to the city.

The office of the management of the Exposition changes on June first from New York to 417 South Dearborn St., Chicago.

CONTRIBUTION TO THE STUDY OF THE VISCOSITY OF LUBRICATING OILS.

The conclusions arrived at by P. Nicolardot and Geo. Baume, as the result of careful investigations, are as follows:—

1. Barbey's viscosimeter, which is the one in general use in France, yields very satisfactory results, especially at ordinary temperatures, except for very viscous oils, in which case the error may be as high as 8-10 per cent., or for oils with very low viscosity, when the temperature is sensibly different from that of the atmosphere.
   If F = the Barbey degrees of an oil, d = its density, and n = its absolute viscosity, then
   $$n = \frac{48.5d}{F}$$
2. Engler's viscosimeter, which is official in Germany, yields much less accurate results. The error may even be over 20 per cent., an dit can still be as great as 10 per cent., even when applying Ubbelohde's correction according to the equation
   $$n = 0.01d\ (7.32E - 6.32/E)$$
   where E = Engler degrees. If E is very large (over 15), this expression practically becomes
   $$n = 0.0732dE.$$
3. The relation between Barbey and Engler degrees is as follows:—
   $$\frac{4.850}{F} = 7.32E - \frac{6.32}{E}$$
   or, if E is large (over 15)
   $$\frac{663}{F} = E$$
4. The method recently brought forward by Dubrisay is unreliable, on account of the error due to the surface tension and the density of the oil.
5. The "rise method" recently perfected by Baume and Masson is useful for measuring very high viscosities, especially at temperatures below 0 deg. C.
6. The "ball method" has given very satisfactory results with the apparatus devised by Aubert and de Laroche.
7. The very simple contrivance recently studied by Baume and Erckmann can render valuable services for liquids having very high viscosities.

The authors hope to undertake a similar study on the Redwood and Saybolt viscosimeters in the near future.—Chimrie & Industrie, Vol. I., No. 3, Aug., 1918.

X-RAYS FOR STEEL BARS.

X-rays, which have hitherto been used only to disclose defects and injuries hidden from sight within the human frame, are now to be used to examine inanimate materials, like steel and timber. The whole subject was discussed at a joint meeting of the Faraday and Rontgen Societies, the chair being occupied by Sir Robert Hadfield, who some time ago initiated experiments in radio-metallography at the Research Laboratory of his firm in Sheffield.

One obvious application of the X-rays is to the examination of metal castings for defects, such as blowholes, which cannot be revealed by external inspection, and yet may seriously impair the strength of the finished article. If the castings are not too large, each of them may be subjected to routine testing by the rays, and it may be found that by some alteration in the method of casting, blowholes, that occur regularly at some particular point, can be eliminated. The rays may also be employed to study the effect of adding different quantities of aluminium to steel, and thus to ascertain the proportion most suitable for the production of sound castings.

Rough analysis of different steels is also feasible. Since different metals vary in the resistance they offer to the penetration of the rays, according to their atomic weight, it becomes possible to distinguish different alloys. Thus, as suggested by M. Schneider, at whose works a good deal of radio-metallographic inquiry has been carried out, if a number of carbon steel and of tungsten steel bars had been accidentally mixed up together, they might be quickly sorted out by means of X-rays. The radiographs obtained with the former are blacker than with the latter, because the rays penetrate the tungsten steel less freely than the carbon steel, owing to the higher atomic weight of the constituent tungsten.

The method has its limitations, because at present the rays can be made to penetrate only a few inches, about four at the most, of ordinary steel, and a still smaller thickness of special alloy steels. But great improvements have been made in recent years by the aid of the Coolidge X-ray tube and of exciting currents at very high electrical pressures. Further advances may be looked for, not only in this portion of the apparatus, but also in the methods employed for detecting the rays after their passage through the material under investigation, whether by photographic plate, the fluorescent screen or the phenomena of ionization.

CHINESE CHEMICAL TRADE.

Mr. J. W. Ross, Trade Commissioner at Shanghai, China, has recently made a business trip through the Dominion.

He points out that soda ash and caustic soda are in great demand for use in the soap and dye industries. Scented soap formerly came from France, but more recently from Japan. England holds a large share of the soap import business. China produces large quantities of bean oil, vegetable and animal tallow and has large industries based on these products. Alcohol is produced in a large way from Kaioling grass. This is a great Manchurian product. It grows like corn in Canada and produces large red berries from which alcohol is made by fermentation and rather crude distilling plants. The stalks are used as firewood and the leaves are fed to cattle while the grain is made into meal. Annual production of alcohol was estimated at 4,000,000 gallons. There is an increasing demand for medicinal salts.

Native products find a world market and we import nut galls, turmeric, oil of anise, cassia, while there is some production of natural indigo and castor oil.

When chemical manufacturers are considering trade with China, several points must be remembered. The most important of these is the use of a trade mark and distinctive label. The native buyer has a tendency to stress this point. If the product put up in a certain way has been found satisfactory, a repeat order is sure for this brand. Firms have

their buying "shroff" and their selling "shroff." These are natives who act as agents for foreign firms. The system of buying is such that much must be done in secret or the tendency is for the price to go up beyond all limits, even at a loss of the sale to the producer. When the world needed antimony the Chinese put the price up many times. The result has been that Chinese antimony did not do much business that was possible and strong connections were not made. Unless new allied firms are careful, there is a danger that the German dye interests may be able to get back their markets in China through the old labels with which the Chinese were very familiar.

Japan has a great market in China and has control of many natural resources in iron and metals. Lack of transportation distorts values beyond recognition. In some thickly populated districts a good sheep may be the equivalent in trade of an empty glass bottle. The future development in industry is uncertain, but it would appear that with the extension of railroads a new spirit of industry may be created and some real interest shown by Government officials in a real national development of the country.

WHAT OTHER NATIONS ARE DOING.

The Saskatoon Star in a recent issue gave the following poignant facts in an editorial which, we believe, will be worth the while for our readers to seriously peruse:

"The economic status of nations is determined by the quantity of raw materials which each possesses and the methods employed to utilize scientifically those resources for the building-up of basic national industries. Great Britain, Germany and the United States have constructed their economic structure, having for their corner stones iron, coal and oil. Germany built up her foreign trade chiefly as a result of utilizing the products from the distillation of coal. These products furnished the materials for Germany's trade, military policy and empire building. The national significance of the raw materials mentioned was well known to Germany and was evidenced in every offensive, each being directed into coal, iron and oil-bearing territory. Germany possessed only 4.5 per cent. of the world's supply of coal, but built up an empire by utilizing it in a scientific manner, having in mind a definite national objective.

"The latest figures concerning the world's coal supply and its distribution prove beyond question the economic national resources of the United States and the position which that country will inevitably hold in the world's trade. In 1870 Great Britain's output was 124,000,000 tons, and in 1918 it reached 255,000,000 tons, or a little over double. In 1870 the United States' output was 33,000,000 tons, and in 1918 it was 685,000,000 tons, or twenty-three times as much. In all the rest of the world outside of Great Britain and the United States in the same period the increase was from 80,000,000 to 500,000,000 tons, the latter considerably less than that of the United States alone. Those figures refer only to the quantity of coal produced for consumption.

"The figures in regard to the total 'available supply' probably cannot be determined with much certainty. However, the total is estimated at approximately eight thousand billion metric tons, of which the United States possess 51 per cent., Canada ranking second with 17.5 per cent; China less than 12 per cent.; Great Britain 5.4; Germany 4.5. It is apparent that Canada occupies a strategic position within the Empire.

"Important action has been taken by the Governments of both Britain and the United States in regard to the coal industry, while in the readjustments of the industrial life of the war countries proper an immense development will certainly come with the peace. The preliminary investigation already held into the coal industry of Britain, which resulted in a truce with the workers, opens the way to a still further inquiry as to the general organization of the coalfields and the industry as a whole and possible revolution which will greatly increase the efficiency of coal.

"The plans of the United States are: That all facts relating to the industry or any question touching it, such as the cost of living, the cost of production, labor conditions, transportation facilities, and other factors entering into the cost of coal, be officially and accurately ascertained by some of the regular Government agencies; that the President designate some cabinet officer or other appropriate official to represent the public in considering any policy proposed; that as advisers to the Commissioner there should be an equal number, say three, of representatives of operators and miners; and that the commission should make recommendations to the President. The plan, modified to suit diverse conditions, is suggested for other basic industries as well, so that the Government would be placed in possession of intimate facts, figures and findings and recommendations in meeting industrial problems as they may arise.

"It is important to note that in the oil industry, the leading producers, refiners, distributors and other petroleum industries of America, Mexico and Canada, have organized the American Petroleum Institute which will be to the petroleum industry what the American Iron and Steel Institute is to the steel industry. The objects of the institute are: To afford a means of co-operation with the Government in all matters of national concern, to foster foreign and domestic trade in American petroleum products, to promote in general the interests of the petroleum industry in all its branches, and to promote the mutural improvement of its members and the study of the arts and sciences connected with the industry. The institute is the outgrowth of the organization of the entire American petroleum industry for war service.

"Everywhere there is indication of intense industrial development and of employing natural resources of each country to their utmost capacity. There are signs in Canada of the awakening process. The formation of a committee of Western members of Parliament is one of them. The action of the Alberta Legislature in forming a department of natural resources is another. A seismic disturbance at Ottawa is due; one also at Regina."

INTER-ALLIED CHEMISTRY FEDERATION.

It is hoped that by the end of July, this year, plans will have been consummated for the establishing of an inter-allied federation of pure and applied chemistry. Professor Henry Louis, professor of mining at Armstrong College, Newcastle, and president of the Society of Chemical Industry, attended a conference in France during the third week in April with the leading chemists of the Allied countries at which plans were laid for allied co-operation in chemical industry. The federation will be the result of this conference.

INCORPORATIONS.

Guelph, Ont.—Crows' Iron Works, Limited. Capital, $2000,000. Charles L. Dunbar, barrister, Guelph. Manufacturers and dealers in iron, steel; metallurgists and iron founders.

Winnipeg.—Stewart and Cameron, Limited. John D. Cameron, barrister, Winnipeg. Abattoir, packing, cold storage, and ranching business. Capital, $100,000.

Montreal.—Industrial Export Company. Capital, $50,000. Charles A. Hale, barrister, Montreal West. Manufacturer and dealer in chemicals, oils, paints, iron, steel, etc.

Toronto.—S. F. Bowser Co., Ltd. Elmer E. Cummings, manufacturer, Toronto. Capital, $750,000. To manufacture and deal in oil, storage, etc.

Montreal.—The W. K. Jahn Co., Ltd. Edwin B. Busteed, barrister, Westmount, Que. Manufacturer and dealer in food products, drugs, chemicals, and essences. Capital, $10,000.

Montreal.—The Canadian Sanitas Co., Ltd. J. C. Mayer, merchant, Montreal. Capital, $100,000. Manufacturer and dealer in chemicals, pharmaceutical, oils and colours.

Montreal.—H. H. Symmes & Co., Ltd. Capital, $25,000. A. Gamache, broker, Montreal. Manufacturer and dealer in cement, asphalt, etc.

Montreal.— Crescent Supply Co., Ltd. John W. Blair, barrister, Westmount, Que. Develop and sell, peat, coal, mineral and other deposits. Capital, $50,000.

Montreal.—Canada-Mexico Oil Co., Ltd. E. M. McDougall, barrister, Montreal. Capital, $600,000.

Vancouver.—Jervis Copper Co., Ltd, (N.P.L.), $500,000. Mining, smelting and refining.

Vancouver.—Skeena Mining and Milling Co., Ltd. (N.P.L.) $250,000. Mining and development.

Cranbrook, B.C.—Beattie-Noble, Ltd., $25,000. Chemists, druggists, etc.

Victoria, B. C.—B. C. Household Specialty Mfg., Co., Ltd. $10,000. Manufacturers of furniture polish, washing-powder, soap, paints, etc.

Victoria, B.C.—The Alunite Mining and Products Co., Ltd. $300,000. Miners, manufacturers, importers and exporters.

Vancouver.—Home Oil Co., Ltd. (N.P.L.), $300,000. To cary on business of mining, smelting and oil refining.

Vancouver.—Hyatt Steel Products, Ltd., Granville Island, $300,000. Taking over the busines of the Canadian Metals Ltd., of Vancouver. Steel-makers, iron-founders, machinists, etc.

Vancouver.—Western Resources Ltd., $20,000.

Vancouver.—Van-Tex Oil Refining Co., Ltd., $250,000.

Vancouver.—Noble Metals, Ltd., $50,000.

Vancouver.—Leach River, Hydraulic Mining Company, Ltd. Capital, $100,000.

Vancouver.—Province Oil and Gas Co., Ltd. Capital, $250,000.

Vancouver.—Western Minerals, Ltd. Capital, $30,000.

Renfrew, Ont.—Renfrew Electric Products, Ltd. John A. Jamieson, manufacturer, Renfrew, Ont. Capital, $500,000.

Montreal.—Sanatogen Company of Canada, Ltd. Capital, $100,000. William W. Barry, chemist, Montreal. Manufacturers and dealers in chemicals and pharmaceutical preparations, oils and colours.

Toronto.—Canadian Hauck Burner Company, Limited. Manufacturer and dealer in oils, acetylene, oxygen, nitrogen, hydrogen and other gases. Capital, $10,000.

Hamilton, Ont.—Industrial Varnish Works, Limited. Capital, $100,000. Morley P. Van der Voort, barrister, Hamilton.

Toronto.—Clay Products Agency, Ltd. Capital, $100,000. Mervil MacDonald, barrister, Toronto.

Ferro Alloys Iron and Coke Company, Ltd. Capital, $100,000. Henry H. Davis, barrister, Toronto.

A. M. Castle Engineering Co., Ltd. Jacob H. Greenburg, Toronto. Capital, $275,000.

Willastone Mines, Ltd. Capital, $2,500,000. Charles H. Kemp, barrister, Toronto.

McGuire Kirkland Gold Mines, Limited. Capital, $350,000. Kenneth McCrae, engineer, Toronto. Mining and smelting.

Oliver-Berkley, Ltd. Capital, $50,000. Harry C. Mendoza, agent, Toronto. Dealers in dyes, soaps, perfumes, grease, tallow glues, paints, varnishes, etc.

Montreal.—Hydro-Chemical Company, Ltd. Capital, $100,000. William J. Moody, Kitchener, Ont.

Scottish Rubber Co., Ltd. Capital, $100,000. Gui C. Papineau-Couture, Montreal.

Quebec, P.Q.—Jos. Cote, Limited. Capital, $250,000. Joseph Cote, merchant, Quebec. Dealer in perfumes and pharmaceutical products.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

Producing Ferro Silicon of High Silicon Content in Blast Furnaces, Johnson, Jos. E., Jr., 189,595, April 8, 1919. A blast containing 0 in greater proportion than in atms. air is used.

Muffle Furnaces, T. W. S. Hutchins, 189,105, March 18, 1919. A series of chambers surrounding a gas producer has a muffle furnace in each chamber.

Production of Alumina, Ralph H. McKee, 189,848, April 22, 1919. Al_2O_3 is removed from Al materials containing Fe and motive basic sulphates of Al by dissolving the material in an acid solvent, fractionally removing Fe by electrolysis and then electrically pptg. the Al as hydroxid and simultaneously regenerating the acid solvent for reuse in the initial step.

Concentrating Deslimed Pulp by Flotation, Rudolf Gahl, 189,754, April 22, 1919.

Producing Iron and Steel, W. T. Stephens, 188,823, Feb. 25, 1919.

Apparatus for Ore Concentration, F. Groch, 189,505, April 8, 1919. The impeller has a rotatable hollow body having axial inlet ports in its opposite walls and a peripheral discharge opening, a partition within the body in spaced relation to the opposite walls thereof and terminating short of the periphery and dividing said hollow body into compartments and impeller blades in at least one of the compartments, the blades extending beyond the partition.

Apparatus for Ore Concentration, F. Groch, 189,631, April 15, 1919. Relating to air movements. The app. is specified.

Treating Gases and Vapors Electrically, W. T. Hoofnagle, 189,634, April 15, 1919.

Treatment of Gases Obtained from Coal and Other Carbonaceous Fuel, E. V. Espenhahn, 189,364, April 1, 1919. Gases are purified by treating them at a temp. about their dew point with a conc. soln. of $Na_4Fe(CN)_6$.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

With a few exceptions, chemical manufacturers report trade conditions to be stronger than last month. "Things are gradually becoming healthier; enquiries are coming from some customers, the first in months from certain of them, and that in itself is a very healthy sign," said a Toronto manufacturer while speaking of trade conditions. Some houses are expressing disappointment that orders are not coming in very fast, but, if one really studies the situation, he will see at once that a rush of orders should not be expected. One must remember that the chemical market, like many another one, has been badly upset, the change from war to peace conditions affected the chemical industry as no other, with the possible exception of the copper and steel. That such a condition could be righted over night is impossible, and it is indeed remarkable that it is being adjusted as well as it is. While business could certainly be very much better, yet one fact is indisputable, and that is, that it IS GETTING better, and that, coupled with the certainty that there is a busy future awaiting chemical industries in Canada, makes the sound basis on which manufacturers may rely for future business. This is well illustrated by a manufacturer of heavy chemicals, who informed the Journal that the very fact that many of his old customers who had been sitting back waiting for something to happen (that is for prices to drop), were making enquiries from which some good orders had resulted. From Montreal, however, the reports are not so optimistic, as from Toronto and Western points. A Montreal chemist, after making a tour of the manufacturers and dealers there, states that there is little demand, while manufacturers are afraid to reduce prices owing to the uncertainty of the labor market. "They do not know when they may be called on to pay higher wages, thereby adding to the cost of their goods. As a result of the uncertainty they are adopting a more-or-less, hand-to-mouth policy."

Sodium Nitrate—The price of sodium nitrate has dropped some during the past month, and the refined is now selling at 8 cents per lb. Some manufacturers affirm that the Imperial Munitions Board has had difficulty in disposing of their lots, but this report is denied by the Board officials. However, it is understood that representations were made by the I. M. B. to manufacturers to have the latter take the stock of sodium nitrate off their hands.

Aspirin—Probably no drug in the history of pharmacy was ever demanded to such a great extent as was aspirin during the past winter. The 'Flu epidemic, truly international in its spread, caused a demand for this drug, that kept every manufacturer busy to keep up with. In February the price was $2.80 per lb. in 100 lb. lots, in March it dropped to $2.10 to $2.25, as the epidemic diminished; in April it lowered to $1.75 to $2.00; and now the price is reported to be getting firm around $1.35 to $1.60, depending on the grade.

METALS.

Silver—The increase in the price of silver from 1.01 cents per ounce to 1.19 was certainly the most pronounced action that occurred in metals during the past month. When the Government controlled the price of silver it was predicted that were the market allowed to take its course the price would undoubtedly advance. This prediction has been fulfilled since the restriction has been removed. On May 14th inst., an Order-in-Council was passed at Ottawa cancelling the order of August 24, 1918, which prohibited the export of Canadian silver coin, silver bullion and fine silver bars, and almost immediately the price rose to $1.19. The mines at Cobalt produce annually about seventeen million ounces. Whenever the quotation for silver increases one cent per ounce it adds to the value of the output at the rate of $170,000 per car. So the recent advance added to the value of Cobalt's output at a rate of over three million dollars. The price fluctuated for a few days, then dropped, and settled to around the $1.05 mark.

Copper—The price of copper advanced two cents per lb. about May 1st, but has settled again to 18 cents per lb. The market looked much better in the States, where some large orders were received in the regular trade. Data is now available showing metal production during the first quarter of 1919. A general falling off is shown in comparison with war production. In Ontario the decrease amounts to over $4,000,000 for the period. Nickel and copper both declined sharply in production, while silver has decreased by over one million ounces. The high prices tend to keep up the valuation. Gold shows a decrease over first quarter in 1918, but with the strenuous production work now going on, it is very likely that the whole year will show a net gain over previous records. Some metals have slumped badly, more particularly molybdenum. Cobalt and metal oxides show increased values over 1918 figures for the same period.

OILS.

Turpentine—Prices continue very high and are running nearly double what they were one year ago. This is due to the fact that production was rather limited during the war period, and now that export is opening up more freely the price has reached unprecedented limits on the United States market. The Toronto price has advanced 9 to 10 cents per gallon.

Linseed—Another move upward has been recorded in linseed oil and the outlook in regard to supplies presents no especially bright side. The Winnipeg strike is interfering with deliveries and some crushers have withdrawn from the market altogether. Flaxseed has reached higher price levels, and this is largely responsible for the kindred move in linseed oil. The revision upward in linseed oil amounts to 10 cents per gallon, with every indication of a further advance apparent.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	.90
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	—15¼
Aspirin, in 100-lb. lots	Lb.	1.35—1.60
Alchohol, grain, bbl., duty paid	Gal.	8.75
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.10—.12
Ammonium Carbonate	Lb.	.11—.20
Ammonium Chloride	Lb.	.15—.20
Benzoic Acid	Lb.	1.50
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per Ton	$25—$30
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	.04½—.05
Chloroform	Lb.	.45—.60
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	.09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.22
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¼—.04
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85

Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Potassium Bromide	Lb.	—.75
Potassium Nitrate, kegs	Lb.	.24—.26
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	.45—.60
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.16—.18
Sodium Cyanide, bulk, 98-99% in cases	Lb.	.35—.44
Sodium Nitrate, refined	100 Lbs.	7.00—8.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.25—5.75
Sodium Benzoate	Lb.	1.35—1.50
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bicromate, bbls.	Lb.	.18—.19
Sodium Nitrite	Lb.	.15—.16
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	2.50—2.75
Sulphur, roll	100 Lbs.	4.00—4.25
Sulphuric Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphite, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.80—.90
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06½
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	—10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.....
Cobalt, metal	Lb.	—2.50
Cobalt Oxide, grey	Lb.	—1.65
Copper, casting	Lb.	—.17
Copper, electrolytic	Lb.	—.18
Copper, electrolytic, in car lots	Lb.	.18
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.06⅞
Lead, in car lots	Lb.	.06
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.05
Spelter	Lb.	.09—.09½
Spelter, in car lots	Lb.	.07¼
Steel, mild	100 Lbs.	—5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 guage	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.33
Motor Gasline (service stations)	Gal.	—.36
Lighting Gasoline	Gal.	—.38
Naphtha	Gal.	—.32
Coal Oil	Gal.	—.19½
Fuel Oil	Gal.	—7.50
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	35 to 40c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 30c	per gallon
Dip Oil, 20 per cent.	35 to 40c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Flake	.08½ to .09½c	per pound
Naphthalin Balls	10½ to 11½c	per pound
Alpha-Naphthylamin	45 to 50c	per pound

Flotation Oils and Naval Stores

Turpentine, Crude, in bbl. lots (Imperial), gal.	.95—1.00
Spirits of Turpentine, in bbl. lots (Imperial), gal.	1.25
Rosin, Grade G, in 280 bbl. lots	13.27
Rosin, Grade W.W., in 280 bbl lots	16.34

Vegetable Oils

Linseed Oil, raw, in bbl. lots, (Imperial), gal.	2.05
Linseed Oil, boiled, in bbl. lots (Imperial), gal.	2.08

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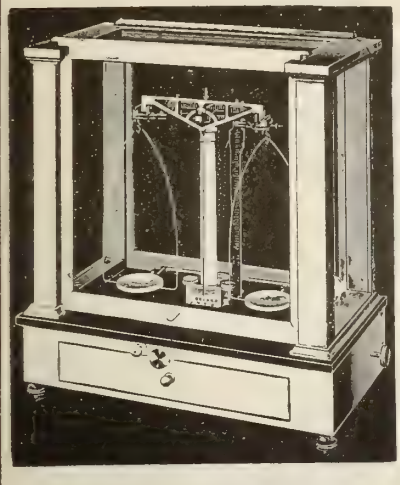

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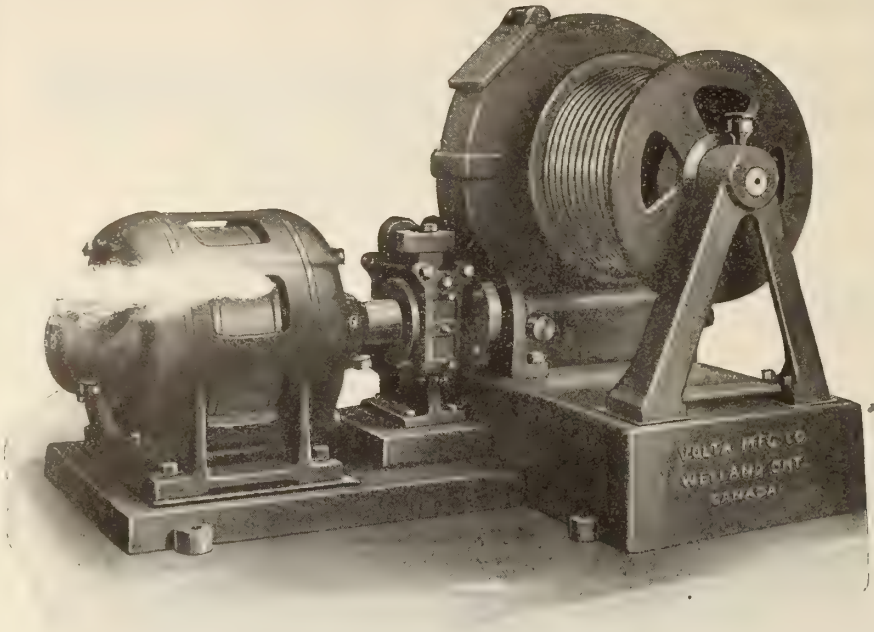

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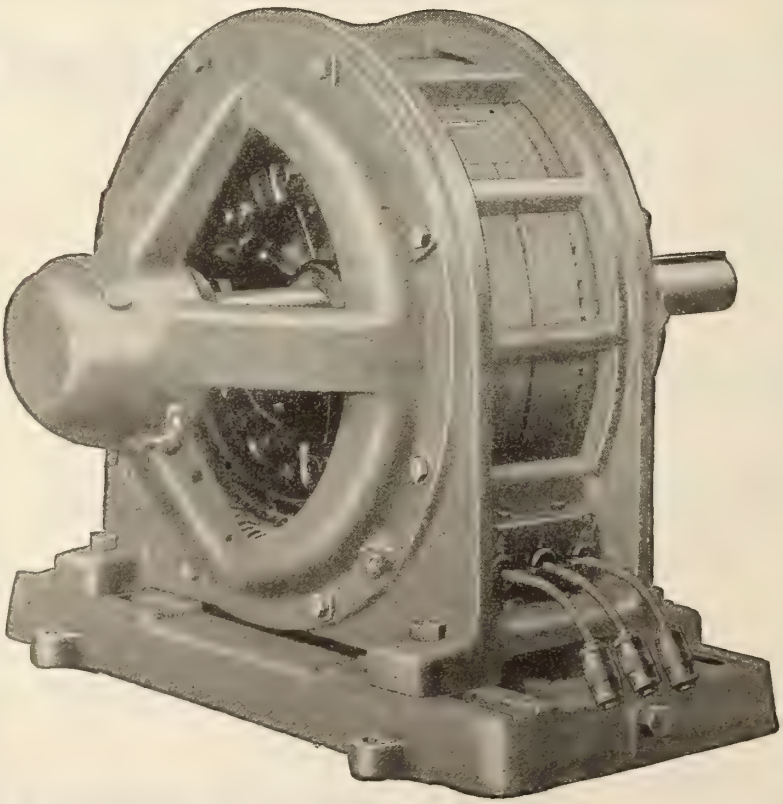

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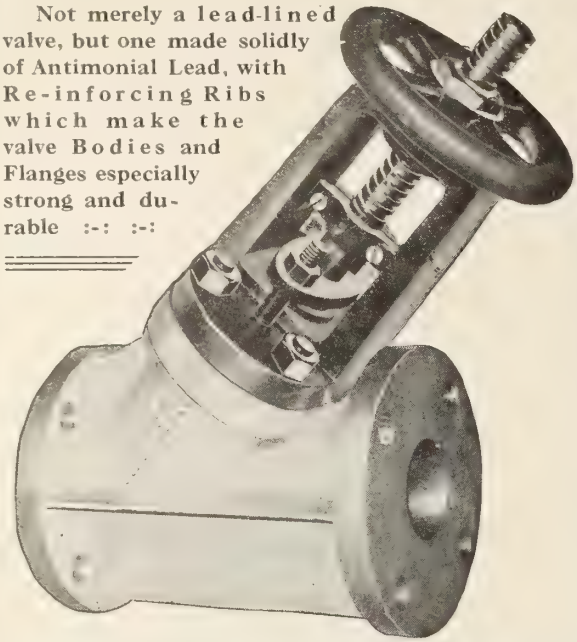

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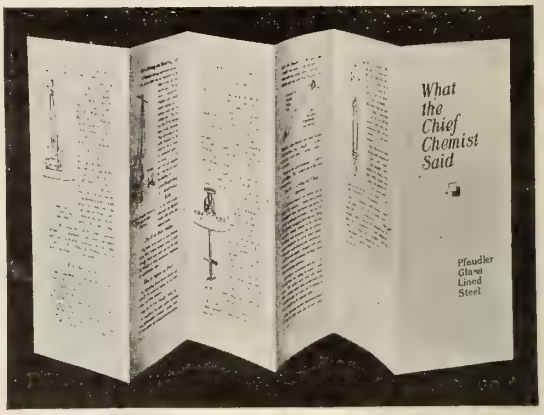

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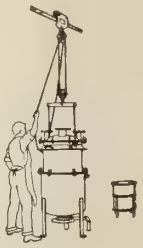

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DEPARTMENT OF LANDS, FORESTS & MINES
BUREAU OF MINES

G. H. FERGUSON, Minister

Apart from the products of the farm, those of the forest and of the mine are of special interest to the chemical and metallurgical industry of America. Ontario's forest and mineral wealth is receiving wide attention and offers great opportunities for the investment of capital.

Forests: Pulpwoods in abundance afford the raw products for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically every mineral with the exception of coal and tin is found in the premier mineral province of Canada. Preliminary figures of output as compiled by the Ontario Bureau of Mines show a valuation of $80,165,720. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:—

Silver	$184,976,626	Nickel	$138,010,436
Pig Iron	78,920,722	Gold	50,864,925
Copper	49,947,080	Cobalt	5,916,834

Non-metallic products include actinolite, arsenic, barite, cement, clay and shale for ceramic industries, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, lime, mica, mineral waters, natural gas, petroleum, quartz, salt, sand and gravel, stone for all purposes, and talc.

Industrial Opportunities: Midway between West an East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities both by rail and water are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Hydro-electric power both potential and developed is available. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula.

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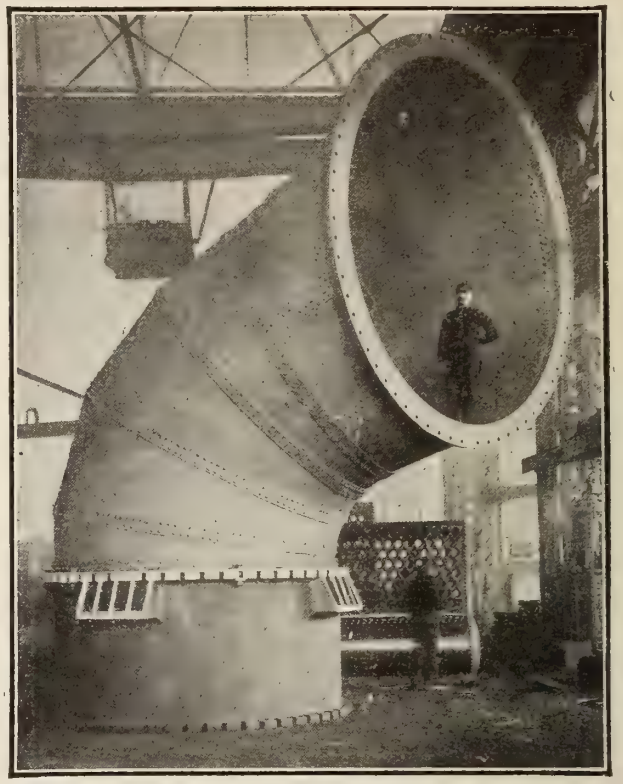

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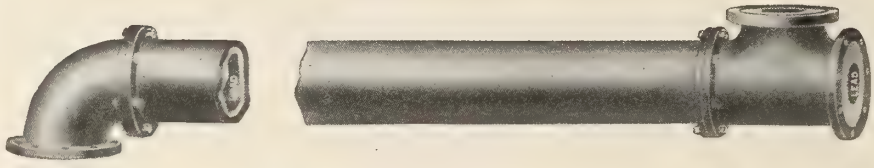

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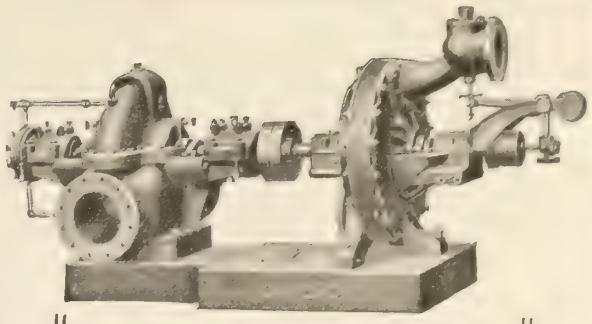

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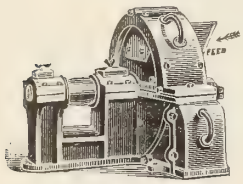

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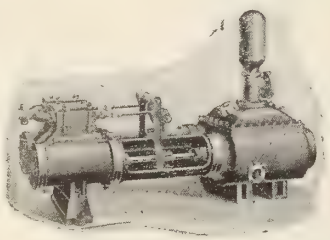

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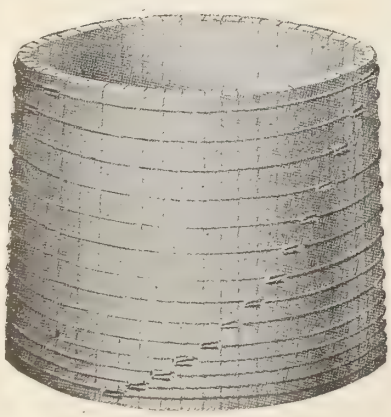

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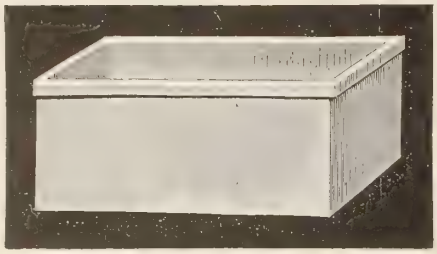

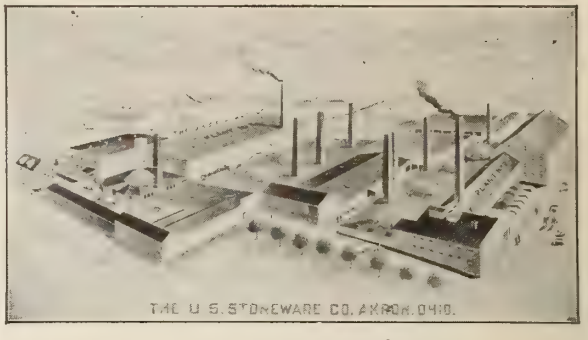

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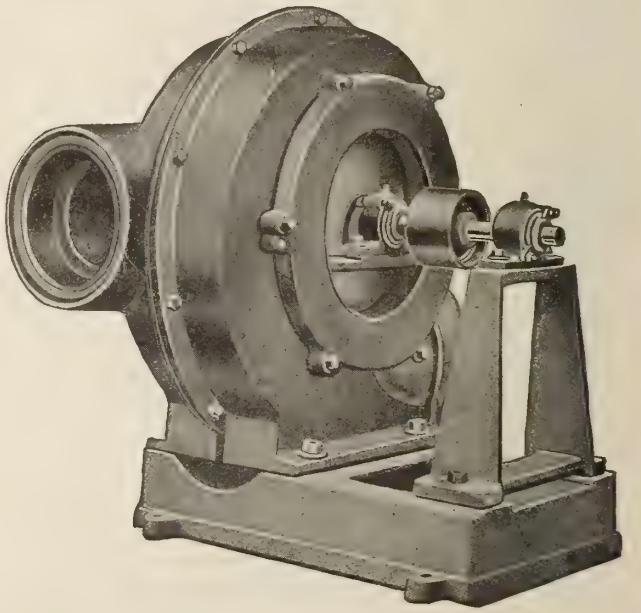

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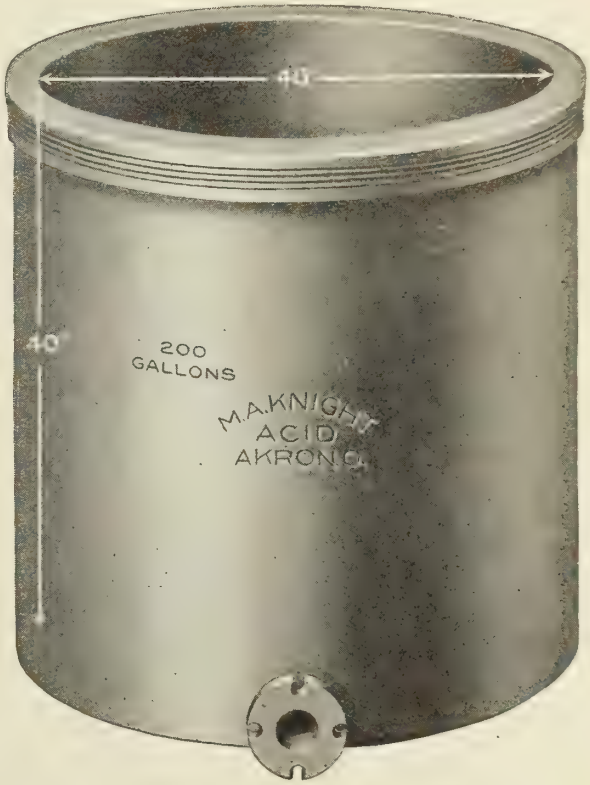

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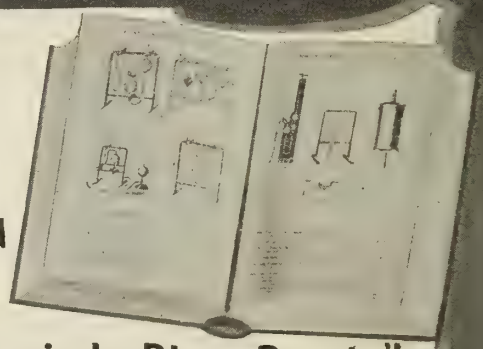

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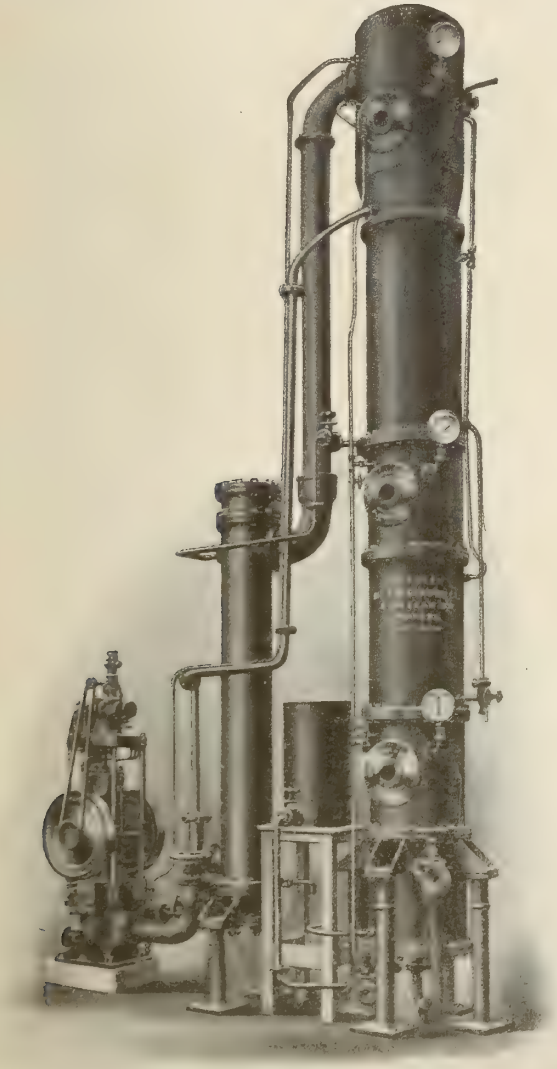

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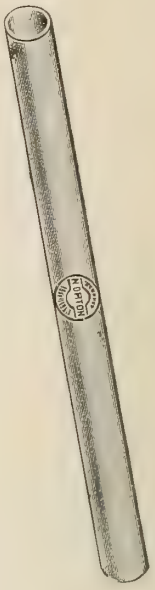

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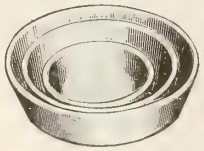

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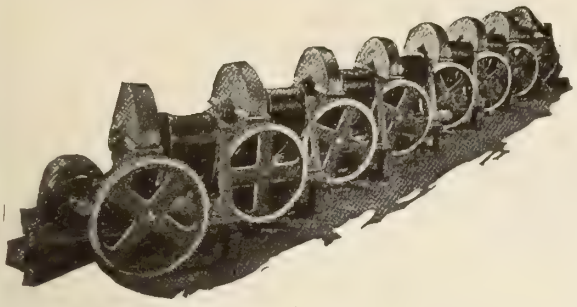

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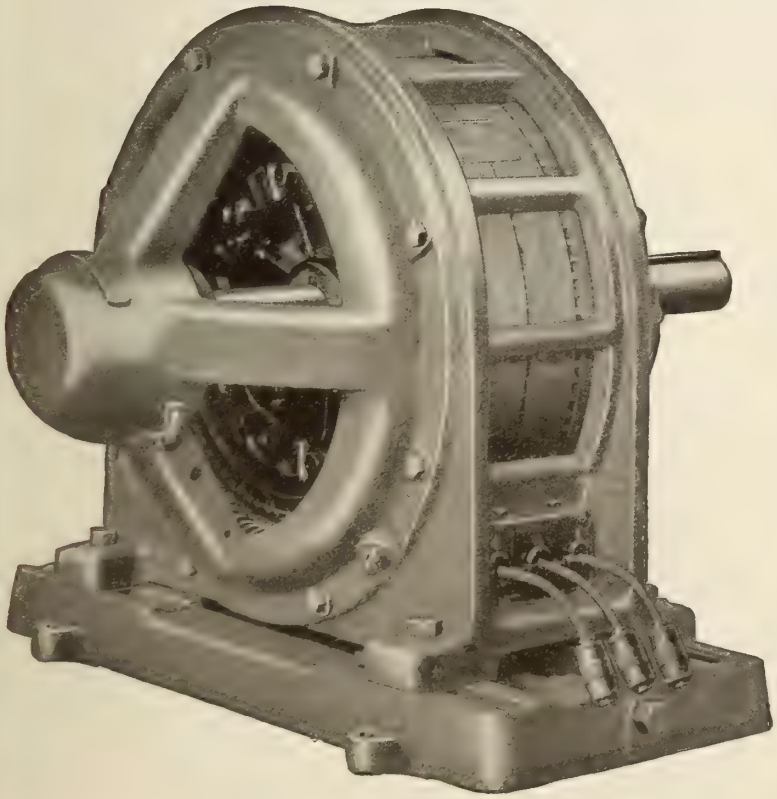

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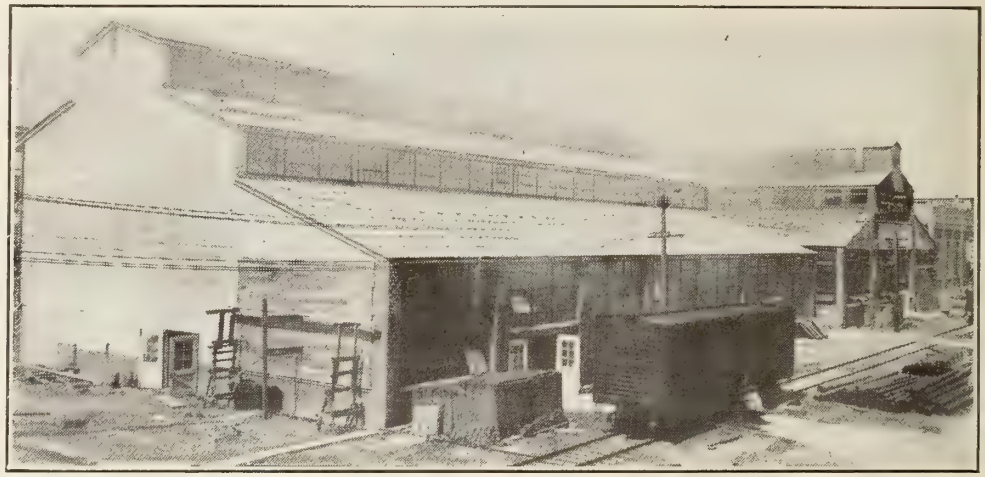

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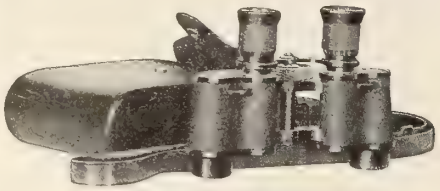

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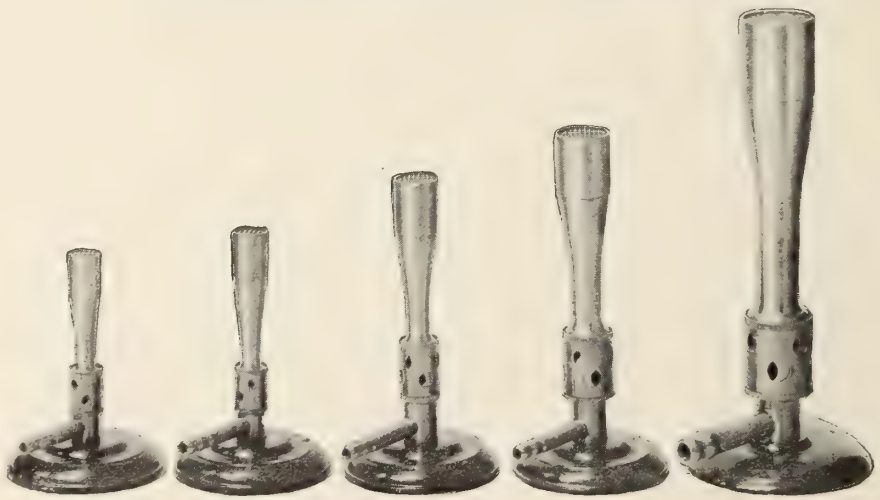

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This Journal is in no way responsible for opinions or statements appearing in contributed articles.

The Editor will be pleased to receive for publication, original papers from chemists, engineers and managers dealing with the results of Canadian research work or descriptive of Canadian resources and their development in any way. Special arrangements of a very satisfactory nature will be made regarding reprints when required.

Commencing with this issue the price per single copy will be 25 cents.

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CIVIL SERVICE SALARIES AGAIN.

THE new Canadian Institute of Chemistry has its first opportunity for service immediately at hand. Under the proposed classification of salaries in the Dominion Civil Service the Chemist has again been rather left behind. A group of so-called Chicago experts have been showing the Government how things should be done during the last year and their report is now ready. While some of the technical men employed by the Dominion Government may be well satisfied it is certainly true that injustice has been done to others.

We doubt very seriously if these experts were really so well informed or capable as their advance advertising would warrant. While they may have been qualified to properly classify certain kinds of labor we do not believe that they possess a single man in their organization who could really judge the relative value of the work of a number of Chemists.

The laboratory service is divided into nine classes with salaries as follows:

Laboratory Assistant	$ 75	to	$100	per month
Assistant Chemist	100	to	140	" "
Associate Chemist	145	to	175	" "
Customs Analyst	150	to	190	" "
Government Analyst	150	to	200	" "
Grain Chemist	160	to	200	" "
Chemist	185	to	225	" "
Senior Government Analyst	210	to	240	" "
Chief Government Analyst	275	to	350	" "

Now to begin with, we believe, these names have no meaning to Chemists themselves. One becomes at once suspicious that no chemist was called in to do this work. Such a rambling set of titles seems absurd. What qualifications distinguish Assistant Chemists from Associate Chemists? Why should a Customs Analyst be different from a Government Analyst and are not all Analysts working for the Government rightfully called Government Analysts? We know, of course, that the worthy gentlemen probably had in mind the old title "Public Analyst," which is defined in the

Adulteration Act. Then why should "grain" Chemists be picked out in particular. We know about food chemistry and cereal chemistry, but this "grain" chemist is a really new variety.

Following all these different brands we at last come to a "Chemist." Words have evidently failed. It is logical to suppose that after being a "grain" chemist for ten years one would suddenly become a "chemist." A Public Analyst under the old order was a man qualified to make exhaustive organic and inorganic analyses, as well as do research on Standards and now we find a "grain" chemist classified in a higher rank. Then again all chief chemists in the Government cannot rightfully be called analysts. Where would a Chemical Engineer doing research work in the Mines Branch come in such a scheme?

The classification besides being utterly foolish is unfair. We find that Associate Zoologists are to receive $215 to $275 per month while a Geologist or an Ornithologist starts at $275 per month.

Now the average Ottawa Chemist is as well fitted for his work as the average Geologist, his work being more exacting and equally difficult, and what we really see here is the result of previous good work on the part of certain heads of departments. This should have been recognized and rectified by the "experts." Instead of doing this it seems evident that ratings were made at the lowest it was judged the staff would stand.

We believe that something can be done if the Chemists of Canada will but try for united action and pressure through the Canadian Institute of Chemistry and the Society of Chemical Industry. The Government cannot expect something for nothing and we defy them to educate any boy paying his full expenses through school and college giving him post-graduate training and then make interest on their money after he takes his living expenses out of $150 per month in times like these. It cannot be done and the Government is simply trading on the natural love some men have for science and their inability to climb out of a hole once they have jumped in. Following all this they have a department designed to urge young men to go in for research work. Surely the Chemical laborer as well as the research worker are both worthy of their hire.

On May 1st this year the Dominion Government offered $2,600 for a party willing to crank a motion picture camera and with the same breath asked for a University graduate chemist with over 20 varying qualifications more to take all the responsibility in connection with the legal examination of any food or drug product for the Department of Trade and Commerce, with the added prospect that if his analysis was not maintained in court he should pay from his magnificent salary of $1,300 the costs of the proceedings.

We appeal to the business men and chemists of Canada who have a clear conception of the relationship of Applied Chemistry to industry to step in now and let a few members and Cabinet Ministers know what they really think of this situation and the above classification.

CHEMICAL STATISTICS.

A DEVELOPMENT of the influence the war has had on Governments is shown by the new interest taken in the gathering together of data relating to statistics of chemical industries. The effort may be somewhat belated, but, nevertheless, is well worth making. In the fever of war information was most hastily gathered and applied in the direction most needed at the time. The helplessness of the allied nations and their utter lack of machinery for producing many materials was but slowly realized at first. These followed a period of rapid stocktaking with electrified research and industry aimed to stop up the larger gaps in our imperfect chain.

Following the awakening in Great Britain and the United States came the resolve that never again would they be found dependent on enemy countries for such important industries as were lacking in 1914. Most of the difficulties could be traced to incompletely developed chemical industries and it is most logical to find all Governments paying new attention to a survey of the real situation within these lines of trade. A part of the work has been the gathering of statistics relating to trade in chemicals and the making of this information more generally available. In Canada we have at least two branches of the Dominion Government actively engaged in collecting information along these lines and it is expected that bulletins will be issued very shortly containing some information regarding our chemical industries.

In the United States the movement has been pushed rapidly by the American Chemical Society and the Department of Commerce has at last given its attention. The result has been the production of the first really concise report on imports and domestic production of chemicals ever put forward by that Government. Miscellaneous Series No. 82 of the Department of Commerce, Washington, reflects conditions of trade as existed in 1913-14, and for this reason is valuable since a true conception is obtained of the strangle-hold Germany had on the American market.

From all reports received it would appear that Germany will still be in a position to sting, and

sting hard, if she is given the opportunity to work back her foreign chemical markets. Four years of war has given the allies the idea and the resolve to never again import German chemicals and dyes, but it should not be forgotten that when the real test comes every agency that can be lined up will be needed to assist British and American chemical industries.

The placing of statistics before manufacturers is, however, the first step and continuous action will be needed if no opportunities are allowed to slip.

In the Industrial Section of this issue we are giving a short summary of such statistics as are available relating to Chemical industries in the United States and Canada.

BLENDING EDUCATIONAL CONCEPTIONS.

MOST people you meet feel that they are fairly well educated. Either through experience or academic work, they have received and retained many impressions which have left them more capable of appreciating and meeting circumstances as they come. There are very few people who still fight against the advances of business and science into the sacred fields of ancient curricula. Groups of men and women are beginning to submerge their particular brands of egotism.

The solid rocks which supported mental altitudes in the past must necessarily break down, if we are to get readjustments of conception. A million factors are continually modifying the mind of the average business man to-day, where one idea beat upon the brain of many of our ancestors. We are thinking in freer, larger terms all the time and there are more people doing the thinking.

To begin with, the unskilled laborer is doomed to extinction. He never really was unskilled, but even the conception of him as such must go. The utilitarian conception of education is becoming more and more general and technical schools are gradually supplanting those ancient institutions known as collegiate institutes.

We are now beginning to see active efforts being made to introduce what might be called a duplex system of training. In theory a business man with technical knowledge along certain lines would be better than one without this knowledge and vice versa. Engineers and technical men need business experience and more particularly hundreds of industrial men and managers need elementary lessons in the general properties of matter.

To make a man suited for many walks in life is impossible. If he is to fill his place, he must be selected early and trained right in the groove. If he is going to be a certain type of business man, needing certain technical knowledge, his training must be held within reasonable limits. The result may be a mechanical failure, but the method is sound. The trouble may lie with the original selection of the individual.

Canada, for example, needs foreign trade representatives. Perhaps there is room for only two dozen of these. The problem of their proper education has never yet been solved. Companies have begun to see the necessity of training men for their work. Every day positions are growing which cannot be filled in a moment by any other man living. These may be lowly positions and it follows that there are many men in exalted positions who would never be missed if they failed to appear again at their offices.

It has seemed to us that the power of applied science, chemistry, mathematics and engineering can only be felt when men who are well trained in these lines knock at the doors of the business world, and demand entrance to positions where they can at least discuss matters with those who started in the good old way by sweeping out the store or cleaning the windows.

These conceptions are taking quite definite shape, and the Commissioner of Education of the United States was instrumental in gathering together a group of authorities last month at Washington for a general discussion regarding special training for business men and engineers. The completely trained business man is coming to the front and if we are not mistaken a time is arriving when professional and technical training will be looked on more and more as a necessary step towards real executive positions.

FOR those Canadian chemists who do not yet fully appreciate the educational and propaganda work necessary before many manufacturers are forced to realize the function of chemistry and their relation to Chemical Societies, the following should be instructive:

A certain well-known Canadian manufacturer and chemist approached a very successful vinegar manufacturer in the interests of the Society of Chemical Industry suggesting that he should join the Society. In all good faith the vinegar manufacturer advanced the argument that it would be impossible for him to connect himself with such a Society because if it became known that he was a member his customers would think that he was putting chemicals in his vinegar

We have others equally good, but the moral is: Get busy as individuals and eradicate our stupendous national ignorance regarding the elementary things of science.

THE TARIFF AND CHEMICAL INDUSTRIES.

SIR THOMAS WHITE, on behalf of the Dominion Government has issued the Annual Financial Statement. The future of Chemical Industries is most vitally affected both by action or lack of it on the part of those who regulate the laws of trade.

While the tariff changes which were made in metals and chemicals were on the whole reasonable and in some instances quite satisfactory, it is still evident from other Government action that our representatives have not always been well advised. The Finance Minister has something to say on the matter of approaching the Government with proposed tariff changes which manufacturers should heed. In the past individuals have gone to Ottawa and presented sound cases, but the mere fact that they were representing individuals only has tended to weaken their efforts. No tariff changes can be made without previous study from every angle of the probable effect.

Sometimes there is a lack of understanding among parties concerned. Their desires may be common enough, but they have not thrashed out all the details properly and it takes a very few discordant notes to have the Cabinet in the mood to put off action until some future date.

The Society of Chemical Industry has often appealed to the Government by resolution. If there are to be tariff changes or any protection given young chemical industries in Canada it would seem that all those interested directly should find within the Society agencies for getting together on common ground. Co-operation of this kind would be very helpful to everyone and there is no doubt but that much of the final punch would not be lost if more careful thought and study were given to preliminary preparations.

A change in the tariff should only be made after the closest study of the last detailed factor involved has been completed. Added to this some weight must be attached to probable future results and it is here that protection of Canadian chemical industries should receive logical support. Let the chemists of the Dominion study these questions and come to some united conclusion. Then it would be expected that the Government would use suggestions with confidence. The relationship of industries offers a field wherein only the highest trained men, after long consideration, should hope to arrive at the best course to pursue in reference to many specific changes in the tariff which might be asked for.

Since it would appear that the Government is willing to really undertake a scientific and not a political revision of the tariff in the best interests of all industries in all Provinces, the very least that industrial groups can do is to prepare their recommendations on a scientific basis and be united in caucus before appearing in the offices of Cabinet Ministers.

THE CHICAGO CHEMICAL EXPOSITION.

THE week of September 22nd will be the most important one of the year for the chemical industries of North America. Everyone will be looking towards Chicago, where hundreds of the leading firms in America and Canada will be represented together. For those who have followed the Exposition at New York, no words of inducement will be necessary to take them to Chicago. For manufacturers who are not familiar with the chemical industries of America an educational opportunity is offered which a few years ago would have been dreamed impossible even by leading chemists.

Products are shown, operations demonstrated and explained and a most wonderful variety of new materials are seen each year. At the same time the men connected with allied chemical and mining societies meet in conference. The Institute of Mining Engineers, the American Electrochemical Society, the American Ceramic Society and the Pulp and Paper Association will all hold meetings during the week. The motion-picture programme will be most elaborate and entertaining, and some novelties are promised.

Canada will be represented by a Canadian Section, where the provinces of Manitoba, Ontario and Quebec will demonstrate the resources of the country. It is expected that the Canada Carbide Co., the Canadian Electrode Co., the Canadian Electro Products Co., and the Canadian National Railways will be represented. The Canadian Chemical Journal urges you to make this either a business or a holiday trip and if you go we shall be there to welcome you to the Canadian Section.

Make the Chicago Coliseum your headquarters for the week of the Fifth Exposition of Chemical Industries.

THE IMPORTANCE OF SALT

WHILE salt is not a mineral of rare occurrence, the extent and character of the deposits of Southwest Ontario are a unique feature of the geology of the western hemisphere. Remembering that a number of the chemicals based upon salt are essential to several of the great industries of Canada, and remembering also how the possession of the same raw material gave Germany a command of many chemical products before the war, it should be a plank in Canada's policy to see that these industries, now passing through their birth pangs, are safeguarded in a way to ensure permanency.

Natural Deposits of Salts of Magnesium and Sodium near Clinton, British Columbia*

A description of commercial deposits of Magnesium Sulphate and Sodium Carbonate

By L. REINECKE

Epsom Salt.

ON the Ashcroft road, one mile south of Clinton, is a round lake about 24 acres in extent, whose upper surface is covered with circular rings of nearly pure Epsomite or Epsom salts (Plate V.). A larger lake, two miles further south on the road, carries a solution of magnesium sulphate, with a concentration of 10 deg. to 18 deg. Baume. Other lakes of Epsomite occur on Kruger Mountain, on both sides of the international boundary near Oroville, Washington.

Epsomite, $MgSO_4 7H_2O$, is a white translucent mineral crystallizing in the orthorhombic system with prismatic habit. In the Clinton deposit, its four and eight-sided, rodlike crystals are characteristically developed. They are clear and translucent when first excavated, but become white and earthy on exposure to the air. Magnesium sulphate is used in the drug trade, for tanning leather, and in the manufacture of textiles.

The smaller lake which is being worked for Epsom salt at Clinton consists of numerous circular, closely spaced areas of Epsom salt overlain by a few inches of brine, and between them there is a dark mud mixed with Epsom salt. This is the same structure in plan as that of the salt in the "Bitter Lake" of Epsom salt on Kruger Mountain, described by Jenkins,[1] (Figure 1), and also of the Last Chance soda lake (Plates VI. and VII.), described below. The pools are flat on top and in cross-section the under surface appears convex or cone shaped. The Clinton pools consist of a nearly pure layer of Epsom salt at the surface, and other layers of Epsom salt more or less mixed with mud and with a small percentage of sodium sulphate below. They are from 10 to 20 feet or so across at the surface and some of them are 4 feet deep near the middle. Between pools and below them there is a dark mud containing Epsomite and some hydromagnesite. There has been no further exploration in depth. The ground near the lake shore is underlain at a foot from the surface in many places by a bed of hydromagnesite. According to Jenkin's description, the smaller of the Epsomite lakes at Kruger Mountain is a rock basin without outlet. On bedrock, there is a thin layer of clay and gypsum, followed by an 11-foot bed of Epsomite overlain by mud and inverted cones of Epsomite that reach to the lake surface. The inverted cones have flat circular tops that are covered by a few inches of brine and are lower in elevation than the interstitial mud surface. Sulphated waters formed by the oxidation of pyrites are presumed to have dissolved magnesium from the surrounding bedrock in this lake and carried the solutions into the basin, where it was precipitated. Jenkins believes that the cone-shaped masses in the upper part of this lake were formed from solutions percolating upward into the mud from the lower bed of Epsomite. He suggests that the solutions crystalized in the mud and the force of the growing crystals helped to open a space for the deposit, which grew in width upward until the surface was reached.

The nearly pure layer of Epsomite at the bottom indicates that the basin is fed by underground springs, a supposition strengthened by the fact that it has a drainage area of less than one-half a mile.[2] The formation of this layer and the mud above are easily explicable by cyclic changes of climate from arid, in which practically no sediment washed into the lake, to wet, in which much mud and leaves, etc., were washed in. (See Fig. 1.) The objection to Jenkin's explanation of the formation of the cones is that, if they reached the surface by forcing their way upward through the mud, their upper surface would be irregular in profile, partly mud covered and farther from the surface in certain places than others, instead of which they are plane horizontal surfaces at the top, and consist in certain places of very clean salt. It seems to the writer that at Kruger Mountain and Clinton the extremely soluble salts of magnesium sulphate, although brought up in the basins by underground waters, diffused into the lake and did not build deposits at their points of issue in the way that the less soluble hydromagnesites seem to have done. If a cycle of increasing aridity should follow one of rain and wet weather, one would expect the carrying of mud by surface streams into the lakes to cease, the water to become more concentrated until the salts in the lower and denser layers of brine just on top of the mud would begin to crystallize. Crystallization would begin at many centers and as a crystal formed, it would sink partway into the soft mud. On top of this another crystal

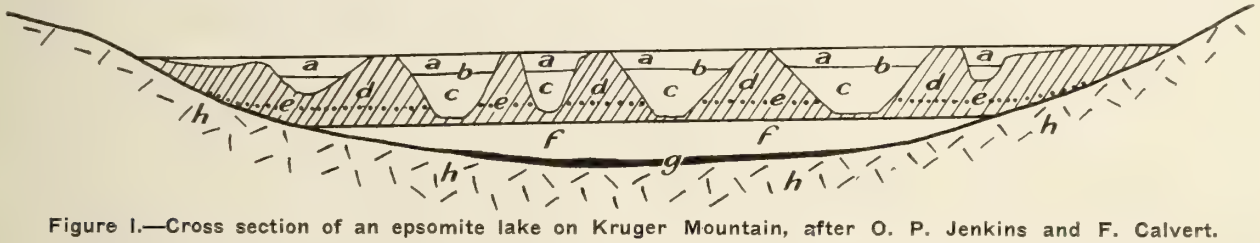

Figure I.—Cross section of an epsomite lake on Kruger Mountain, after O. P. Jenkins and F. Calvert.

Explanation.—(a) and (c) epsomite with thin layer of mud (b).
(d) Mud carrying 25 per cent. epsomite.
(e) Layer of leaves.
(f) Bed of epsomite, 11 feet thick, top of bed about 19 feet from surface.
(g) Thin layer of gypsum underlain by some clay.
(h) Metamorphosed dolomites and shales.

*Article continued from June issue.

[1]Jenkins, Olaf P. Spotted lakes of Epsomite in Washington and British Columbia, Amer. Journ. Sci., Vol. XLVI., Nov., 1918, pp. 638-644.

[2]Jenkins, Olaf P. Op. Cit.

Plate V.—View of the epsomite lake at Clinton, showing runway, piles of epsomite on shore and the railway grade across the valley in the distance. Photographed by Harlan I. Smith.

would form and others, in a little circular ring around the second, at the surface separating mud from brine. There would be further sinking and the formation of a second circular layer of a little larger radius on top of the first. The successive building up of circular layers constantly increasing in diameter would form a cone pointing downward that would sink into the mud by its own weight. The sinking of the cones would force the mud sideways and make it bulge upward at the surface, although the lateral thrust of growing crystals may have helped to produce this effect. Minor weather cycles intervening would account for the muddy layers found in the cones both at Clinton and Kruger Mountain.

Development Work.

Both the Clinton and Kruger Mountain deposits are owned by the Stewart Calvert Co., a firm of industrial chemists, whose works are situated at Oroville, Washington. The salts in the small lake at Clinton are excavated from under a few inches of brine with pick and shovel, loaded on wheel barrows and wheeled out on a wooden runway to the shore (Pate V.), where, after being spread out in the sun to dry, they are screened and sacked for shipment to the Oroville plant. Here the product is dissolved and foreign matter, as well as sodium sulphate, removed. Recrystallization from this solution is controlled, so as to obtain a uniform product with crystals one-fourth inch and less in diameter, in which form it is put on the market. The company began operations in 1918 and had produced about 3,500 tons by the end of February, 1919.

The Clinton Lake covers 24 acres, and if it be considered that the salt in all the pools could form a bed of pure Epsomite, 9 inches thick extending over the whole lake, there should be about 50,000 tons available. The methods of working the Oroville deposits are described by Jenkins.[3]

A curious feature of the Clinton deposit is that the lake bed in which it occurs is said to have been a hay meadow a few years ago. G. M. Dawson, who was one of the keenest observers amongst Canadian geologists mapped this as a lake in the early nineties, but does not mention Epsomite, so that the lake must at that time have been covered with brine of low concentration. There is, furthermore, no mention of the eager gold seekers of the sixties stopping to sample this family remedy on their way to the diggings. These facts point to the very recent forma-

[3]Jenkins, Opus Cit.

Plate VI.—Panoramic view of Last Chance soda lake, about 25 miles north of Clinton. (Photographed by Harlan I. Smith.)

Plate VII.—Closer view of a section of Last Chance Lake, showing soda pools with mud ridges between. The large boulder seen in the ridge in right foreground is one foot in length. (Photographed by Harlan I. Smith.)

tion of the salts now at the surface and the gradual change in the water content of the lake. Taken in connection with the structure of the Kruger Mountain Lake, it would seem to point to the possibility of finding other beds of Epsomite below the muds that underlie the Clinton salt.

Sodium Carbonate.

A number of small lakes carrying brines of sodium carbonate are found at various places on the Green Timber plateau, north of Clinton. The important ones lie in a nearly straight line trending about east, west through the 70 Mile House, 23 miles north of Clinton. There are numerous other lakes carrying small quantities of sodium carbonate in solution.

Sodium carbonate is marketed in many forms:

(1) As soda ash, Na_2CO_3, it is used very widely in nearly all chemical industries, especially in making dyestuffs, explosives and in glassmaking, and as sodium hydroxide in the wood pulp and soap industries. Soda ash is manufactured by the LeBlanc and Solvay processes from other salts of sodium. It is also made from natural hydrated sodium carbonates.

(2) Bicarbonate of soda, $NaHCO_3$, baking soda or saleratus, is used in cooking, medicine and in the manufacture of drinks.

(3) Salsoda, washing soda, crystal soda or natron, $Na_2CO_3 \cdot 10H_2O$ is found as a natural product in many lake beds. It is also marketed as the monohydrate, $Na_2CO_3H_2O$, and sesquicarbonate of soda,, $Na_2CO_3NaHCO_32H_2O$. There has been a tremendous increase in the use of sodium carbonate during the last 30 years, and the manufacture of it received an added impulse in North America during the war. In 1917, the United States produced 1,578,889 tons of soda ash, valued at $38,374,199; 174,212 tons of bicarbonate, valued at $5,292,374, and 771,939 tons of salsoda, valued at $1,698,520.[4]

The soda lakes north of Clinton are characterized by lack of outlet, very small drainage basins and a rim of white efflorescent salt on their shores. The more concentrated ones by the lack of animal life, except a small red crustacean and swarms of black flies, which seem to live on the salt. Salt crystallizes out of many of these lakes through increased concentration, by evaporation in the summer and through freezing of the water in the winter. The salt so obtained is translucent and nearly colorless, but becomes a white powder upon drying in the air. The translucent salt has, in some cases at least, proved to be natron (crystal or sal soda), $Na_2CO_31OH_2O$, and the white

[4]Wells Roger C., "Sodium Salts in 1917," U.S. Geol. Surv., Min. Res. of U.S., 1917, Part II., p. 306.

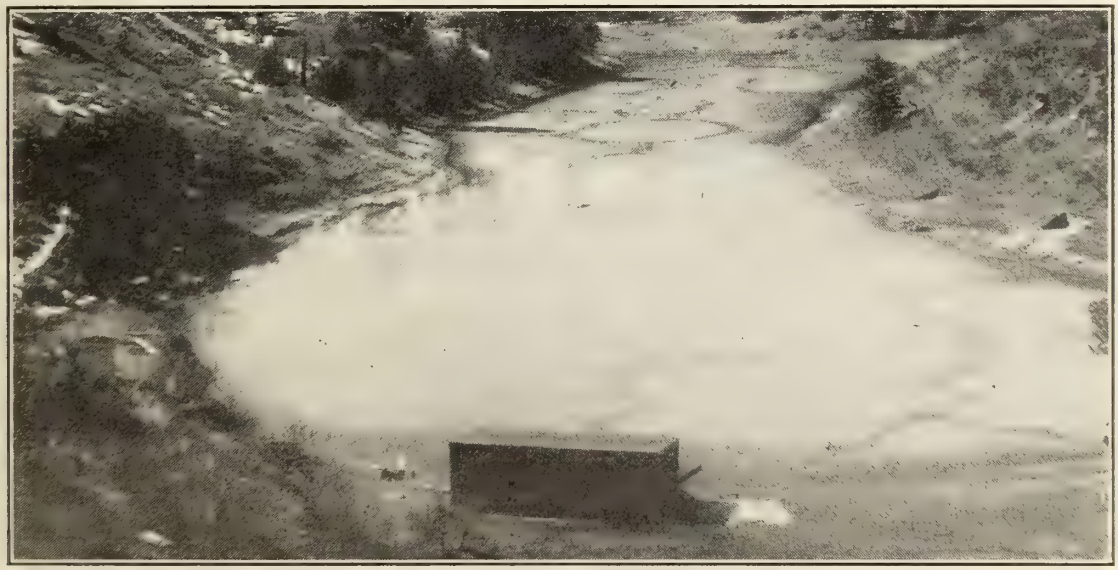

Plate VIII.—A remarkable illustration of ring-like formations of magnesium and sodium salts, near Clinton, B.C.

TABLE II.—ANALYSES OF GYPSUM AND CALCITE DEPOSITS.

	SiO_2	Insoluble including SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	CO_2	SO_3	H_2O above 105° C.	H_2O below 105° C.	Organic Matter	Total	Gypsum Anhydrite	Calcite	Magnesium carbonate and hydroxide
1. Gypsum just above wagon road north of and ¼ mile from west end of Kelly Lake	3.75	....	0.67	0.41	....	0.48	31.48	2.22	41.09	2.18	18.00	....	100.28	*41.6 *36.99	5.0	....
2. Calcite gathered from northeast shore Kelly Lake, mostly under a few inches of water	....	9.30	0.28	0.29	....	0.66	47.70	36.76	0.24	3.72	0.53	....	99.48	0.5	83.5	0.9
3. Impure beaded calcite interstratified with sand and clay in flat west Kelly Lake	....	25.26	0.83	0.80	0.65	0.77	37.14	29.78	0.21	3.55	0.70	....	99.67	0.5	66.1	1.9
4. On hill east of hydromagnesite at Clinton, 400 feet above the flat	....	42.60	1.75	2.25	0.26	2.49	23.04	14.64	6.29	3.73	3.62	....	100.07	13.5	33.00	3.0
5. At Clinton on hillside about 200 feet in elevation below locality 3	....	77.54	3.87	4.04	0 18	2.39	3.30	2.52	0.51	3.82	1.97	....	100.14	1.0	5.3	0.4
6. At Clinton on hillside south of Sample 5	....	60.10	2.62	2.69	0.44	3.33	13.84	10.44	1.37	3.07	1.76	....	99.66	3.1	22.9	5.6
7. Just above the hydromagnesite at Clinton, 6 to 18 inches from surface, Plate IV	9.04	....	3.07	1.27	0.40	1.37	28.42	3.40	33.30	2.23	14.75	1.72	98.97	*42.65	7.7	....
8. Locality No. 6. 2 to 3½ feet from surface just below Sample 7	....	35.86	1.16	1.64	0.29	1.70	19.80	2.60	23.50	3.10	10.92	....	100.57	*22.8 50 5	6.00	....

*The first figure is gypsum, the second anhydrite.

powder is probably $Na_2CO_3H_2O$, which is supposedly also the composition of the white efflorescence on the shores of the lakes.

One of these lakes, the Last Chance, has exactly the same circular pool structure (Plates VI. and VII), seen in the Epsomite deposits at Clinton and Kruger Mountain. In this place, the mud ridges near the edge of the lake are 3 to 6 inches higher than the surfaces of the pools between them, and contain boulders up to one foot in diameter that lie higher than the salt surface.

Analyses of two samples of salt from Goodenough Lake, one from a bed under the water, the other from a stockpile, which had been exposed to the weather for many years; of salt from the top of the crust in Last Chance Lake, and of soda manufactured near the 70 Mile House is given in Table III.; the analyses of two brines in Table IV. All of these show a high sodium carbonate content,

TABLE III.

Analyses of Salts from Soda Lakes.

	1	2	3	4
Soda Na_2O	31.36	21.36	....	37.83
Potash K_2O	trace	....	....	0.05
Lime CaO	....	....	....	....
Magnesia MgO	0.04	....	....	0.09
Silica SiO	trace	0.01	....	....
Alumina $Al_2O_3Fe_2O_3$ and Iron FeO	trace	....	....	....
Carbon dioxide CO_2	22.08	15.46	....	26.70
Sulphur trioxide SO_3	0.11	0.08	....	0.04
Phosphorous pentoxide P_2O_5	....	0.01	....	....
Boron trioxide BO_3	....	trace	....	....
Chlorine Cl	trace	0.01	....	0.37
Water above 105° Cent.	0.84	63.03	....	0.61
Water below 105° Cent.	45.67	....	....	33.98
	99.90	99.96	....	99.67

Hypothetical Combinations.

	1	2	3	4
Sodium carbonate	53.21	35.54	35.96	64.34
Sodium bicarbonate	....	1.34	....	....
Sodium sulphate	0.14	0.14	5.21	0.07
Sodium chloride	....	0.02	0.33	0.28
Potassium chloride	....	....	....	0.11
Magnesium chloride	....	....	....	0.24
Sodium metaborate	....	trace	....	....
Sodium hydrogen ammonium phosphate	....	0.02	....	....
Insoluble	....	....	.02	....
Water	46.47	62.89	58.48	34.59
	99.92	99.95	100.00	99.63

1. From stockpile on shore of Goodenough Lake, near southwest end of Meadow Lake, B.C. Analyzed by Frederick Baridon, Mines Branch.

2. From deposit in Goodenough Lake. Analyzed by R. A. A. Johnston, Annual Report, Geological Survey, Canada, 1898, Vol. XI., pp. 12, 13R.

3. From top of solid crust in Last Chance Lake in northeast quarter, lot 1768, between 59 Mile House and Meadow Lake. Per F. Calvert.

4. Manufactured soda, lake in lots 1792, 1793, 3½ miles west of 70 Mile House, owned by Pacific Coast Contractors, Ltd. Analyzed by Frederick Baridon, Mines Branch.

TABLE IV.

Analyses of Brines from Soda Lakes.

1,000 grains of water contains grains of

	1	2
Sodium, Na	18.3800	37.428
Potassium, K	trace	6.890
Calcium, Ca	trace	.016
Magnesium, Mg	0.0261	.037
Aluminum, Al	none	0.183
Silica, SiO_2	....	0.041
Carbonic acid, CO_3	22.6600	42.845
Bicarbonic acid, HCO_3	3.0600	10.731
Sulphuric acid, SO_4	0.0820	7.326
Chlorine, Cl	0.8590	7.902
Boric acid	none	....
Phosphoric acid	....	.771
Total	45.0671	114.170
Percentage of total solids (dried at 103° C.)	4.53	11.4
Specific gravity at 60° Fahr.,	1.044	1.108
Equivalent to degrees Baume	6.1°	

Hypothetical Combinations.

	1	2
1. Sodium carbonate	38.4500	74.236
2. Sodium bicarbonate	4.0350	.....
3. Potassium carbonate	.....	1.630
4. Magnesium carbonate	.....	0.130
5. Magnesium bicarbonate	0.1571	.....
6. Calcium carbonate	.....	0.041
7. Sodium chloride	1.4150	13.021
8. Sodium sulphate	0.1213	.....
9. Potassium sulphate	.....	13.294
10. Sodium phosphate	.....	0.222
11. Aluminum phosphate	.....	0.825
12. Silica	.....	0.041
13. Carbonic acid unaccounted for	0.8893	10.731
	45.0677	114.171

1. Brine from lake five miles east of 70 Mile House, just southeast of lot 1514, owned by D. B. Hutchinson. Analyzed by Frederick Baridon, Mines Branch.

2. Brine from Goodenough Lake. Analyzed by F. G. Wait, Annual Report, Geological Survey, Canada, Vol. XI., 1898, pp. 48 to 50R.

with very little impurity. Small percentages of potash were obtained from the brines of Goodenough and Last Chance Lakes.

These soda brines are believed to have been transported to their present positions by ascending solutions connected with the volcanic activity which caused the extrusion of the basalts.

Sodium carbonate was excavated from Goodenough Lake, which lies at the southwest end of Meadow Lake about 16 miles west of the 70 Mile House, many years ago. About 16 cubic yards of it is still lying in an old shed on the shores. This lake covers about 15 acres and must contain something over 15,000 tons of sodium carbonate. About 4 miles west of the 70 Mile House and the railway, the Pacific Coast Contractors, Ltd., of Vancouver, are manufacturing soda from a lake covering 85 acres, 3 to 4 feet deep, with about a 6 per cent. solution of sodium carbonate. The brine is pumped into a large concrete tank, where it is boiled down to a certain strength, then drawn off into other tanks to cool and crystallize, while certain impurities and the mother liquor are removed. An analysis of the product is given in Table III. The company uses wood fuel, of which an abundant supply is present. They intend to instal a furnace for converting the hydrated product into soda ash (Na_2CO_3). Their present capacity is about 3 tons, in terms of soda ash, per day. The haul to the railway is about 4 miles.

There are many thousand tons of soda available from this lake and the others in the neighborhood.

THE GRAPHITE SITUATION

A Summary of the whole Graphite Situation as faced by Canadian Producers with a review of the development of present processes of recovery and a discussion of Market Conditions

By HUGH S. SPENCE*

NATURAL graphite is of three types—plumbago, or vein graphite, disseminated flake and amorphous. "Amorphous" graphite, strictly speaking, is a misnomer, since all graphites, as such, possess crystalline structure; but the term has crept into general usage to denote the soft, earthy graphites sometimes found in partly metamorphosed sedimentary rocks, usually slates and shales.

Plumbago commonly occurs in well-defined veins and is the least common of the three types. It is in great demand for crucible manufacture, and the world's supply is derived almost exclusively from the island of Ceylon. Occurrences are known, also, in Montana and in Canada, but the deposits have not been exploited at all actively owing to the narrowness and impersistence of the veins. It seems unlikely that the known Canadian occurrences can ever furnish any important production.

Disseminated flake is probably the most common and widely distributed form of graphite. It is found practically all over the globe, and generally occurs in crystalline rocks of metamorphic type, such as limestones, gneisses and schists. The bulk of the world's supply of flake graphite is derived from Madagascar, Bavaria, the United States and Canada. Madagascar has come rapidly to the fore as a source of flake graphite, the production having risen from 7,000 tons in 1913 to nearly 40,000 tons in 1917. From reports on the deposits, it seems certain that the Madagascar output will be an important factor in governing the feasibility of exploiting deposits of flake in other parts of the world, since large quantities of graphite are said to be procurable from surface workings in soft, weathered rock. Cheap, native labor, combined with the fact that the flake can be readily cleaned of admixed clay, etc., by a system of sluicing, will probably enable Madagascar flake to be laid down even at American ports, once normal freight conditions are established, at a price that will nearly approach the production cost of American flake.

Amorphous graphite is the least valuable form of natural graphite, and owing to its finely divided, earthy character is difficult to refine by mechanical methods. Large quantities are consumed in the paint and foundry facings trades, the graphite and slate or shale matrix being ground up together and air-floated. A common carbon content for amorphous graphite ores is 35 to 50 per cent., and such ores are commercial for some purposes. Certain amorphous graphites, however, such as, for example, that from Sonora, Mexico, are extremely rich (best Mexican runs as high as 85 per cent. carbon) and such high-grade material finds extensive adoption in pencils, commutator brushes, etc. Amorphous graphite of inferior grade (50 per cent. carbon) was formerly mined in some quantity near St. John, N.B., for paint manufacture and foundry facings, but production ceased about ten years ago. No other occurrence of amorphous graphite in Canada has been exploited, though the material is known to occur at numerous localities in the Maritime Provinces.

While Ceylon plumbago has long stood pre-eminent for crucible work, manufacturers claiming that, on account of its dense structure as compared with flake graphite, pots made with it stand up better than those made with flake, it has been a practice in recent years to mix in a certain proportion (10 to 25 per cent.) of flake with the plumbago used. When supplies of graphite in the United States ran low during 1918, it was made obligatory by the government for crucible makers to use not less than 20 per cent. of flake in their wares. From crucibles of English make examined by the writer, it would appear that in some cases the graphite employed in their make-up consisted almost entirely of flake. The matter of the relative refractoriness of crucibles made with the two types of graphite has been under investigation during the past two years, notably by the U.S. Bureau of Mines working in conjunction with the Bureau of Standards, and interesting and valuable data on this question should result from the work carried out.

Canadian Flake Graphite.

While flake graphite occurs somewhat plentifully in a certain section of Eastern Canada, notably in the township of Buckingham, Que., as well as in the townships of Broug-

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(A special report dealing with the graphite industry has been prepared by the writer of this article for publication by the Mines Branch. It is expected that this report will appear in the course of the next few months, and copies may be obtained by application to the Director, Mines Branch, Department of Mines, Ottawa.—Editor.)

ham, Cardiff, Monmouth, North Elmsley, etc., in Ontario, and while the mining and milling of Canadian flake ores commenced as far back as 1866, the industry has never assumed any large proportions. This is due, largely, to the failure that has for years attended attempts to evolve an efficient and economical concentrating process for the ores. A great variety of methods has been tried, but hitherto none can be said to have proved conspicuously successful. The processes that achieved high recovery yielded a dirty concentrate, and, conversely, clean concentrates resulted in low extraction. The result has been that few operators have continued work for any length of time, and, of the dozen or so mills erected in the last twenty years, scarcely more than two or three have been on the list of active producers at any one time. In the last two or three years, however, considerable experimentation has been carried out on graphite ores with the frothing oil flotation method of concentration, and the results achieved have shown that this method offers probably the cheapest and most efficient means of extracting graphite from its ores that has yet been devised. A number of American mills have adopted one or other of the various systems of oil flotations, with highly satisfactory results, and, at the time of writing, the process is being tried out in one Canadian mill and is under consideration by a second. The Dominion mill, near Buckingham, which installed the Callow system last summer, was unfortunately destroyed by fire before the process had had an opportunity of being properly tried out. Since the better grades of Canadian flake ores average 10 to 15 per cent. graphite as against 3 to 6 per cent. in American ores, profits per ton of ore treated would be proportionately greater. It is to be hoped that oil flotation may prove the means of placing the flake graphite industry in this country on a more satisfactory basis than heretofore.

It has been stated that the persistent failures that have attended efforts to develop the Canadian graphite industry are due primarily to impersistence of the orebodies. While the statement that the graphite deposits are of limited extent is true in the sense that the orebodies often partake of the nature of attenuated lenses, usually confined to the contacts of pegmatite intrusions into gneiss or crystalline limestone, it should be added that in the relatively few instances where deposits have been followed to any depth, either by actual mining operations or by diamond drilling, there appears to be no indication that either the size of the orebodies or their graphite content necessarily decreases with depth. The matter of surface enrichment, due to leaching, affects only the uppermost portions of the deposits and has already been referred to above.

Compared with, for instance, the Alabama and Pennsylvania deposits, Canadian graphite orebodies in general must certainly be considered small and usually of irregular form. In Buckingham township, Que., however, to cite the district where the most pronounced development of graphite is encountered, bands and lenses of ore are very numerous practically throughout the entire area of the crystalline rocks, and showings of graphite are to be found scattered over an area of approximately one hundred square miles. The resources of this district in graphite are undoubtedly important and while no conspicuously large orebodies have been encountered, the available tonnage of ore in certain circumscribed areas may reasonably be considered as adequate to justify the erection of moderate-capacity mills. The cost of production of refined flake by old methods has been so high that only the richer ore 10 to 15 per cent. graphite) has been considered commercial. With improved recovery and cheaper milling methods, it will be possible to treat much lower grade ore.

Contrary to what might have been expected, little interest was evinced in the possibilities of Canadian flake graphite during the war, despite the prevailing high price of No. 1 or crucible flake and the acute shortage of crucible graphite in the United States. Only three or four of the pre-existent mills were in active operation during the war period, and no new properties were opened up. In view of the large amount of capital invested during 1916-18 in the Alabama field, where the ore averages only 2.5 to 3 per cent. of graphite, and where some forty mills were in operation or under construction in 1917, as against three in 1913, it is somewhat disappointing that the richer Canadian ores received such scant attention. Much of the work in Alabama was of an experimental nature, and one may well believe that, if a tithe of the energy and capital expended on these low-grade ores had been applied to the ores of, say, the Buckingham district, Que., the mills erected would now be running instead of, as is the case, being for the most part shut down.

Problems in Refining.

One of the chief causes of the failure to refine Canadian flake beyond a certain point is attributed to the fact that mica plates commonly occur interleaved with the flakes of graphite, which mica it has not been found possible to remove by mechanical means without destroying the flake. This point has been brought ont by the Department of Mining Engineering of the University of Toronto*, who are at present conducting experimental work in connection with graphite refining. The presence of microscopic quartz and pyrrhotite, as well as of mica, within graphite flakes, has been determined, also, in the laboratory of the Ore-Testing Division of the Mines Branch, Ottawa. The largest clean flakes were carefully picked out under the microscope from a batch of flotation concentrates made with the Callow system, and these clean flakes were found to assay as follows:

Carbon	92 25 per cent.
Silica	3.00 " "
Iron and alumina	3.60 " "
Undetermined	1.15 " "
	100.00 per cent.

Re-grinding may eliminate a certain proportion of these intimately intergrown impurities, but it is obvious that they cannot be removed entirely without reducing the graphite flakes to such fineness that they become of little commercial value.

A point to be noted in connection with microscopic pyrites and pyrrhotite in graphite flakes is that concentrate running higher in carbon may usually be secured from weathered, surface ore than from unweathered, since much of the iron sulphide is commonly leached out of the former. The resulting acid also attacks any calcite present, thus bringing about a still higher graphite content in such ores. For reliable results, therefore, all tests should be carried out on fresh, unweathered ore and not on surface samples.

The Oil Flotation Process.

Of all the processes for refining flake graphite that have received a trial in actual practice, that of oil flotation has probably given the best results. Several systems of oil flotation have been patented, the basic principles being the same in all cases, and the difference between them lying in the method of producing the froth necessary to float the mineral

*See Can. Min. Journ., March 26, 1919, p. 196.

particles. The Callow, Mineral Separation, and Simplex systems have all been installed in the Alabama field, and the largest mill in New York State has lately also been equipped with the Callow system. A number of parcels of graphite are have been cleaned at the Ore-Testing Laboratory of the Mines Branch, at Ottawa, by means of the Callow pneumatic machine and the results obtained show that oil flotation is admirably adapted to Canadian graphite ores. The following figures were secured on a consignment of 30 tons of a Quebec ore, the run being made in March, 1919. The ore consisted of material varying widely in graphite content and comprised the following:

3,306 pounds assaying 38.18 per cent. carbon
8,092 pounds assaying 18.10 per cent. carbon
48,874 pounds assaying 4.33 per cent. carbon

60,272

The values shown below were secured for the concentrate obtained:

Pounds.	Size.	Per cent. carbon.	Carbon, pounds.
683	+ 50 mesh	95.05	649.19
625	+ 62 "	91.20	570.00
169	+ 74 "	89.75	151.68
637	+ 86 "	90.30	575.21
611	+109 "	87.40	534.01
362	+125 "	88.60	320.73
363	+150 "	87.10	316.17
116	+200 "	85.20	98.83
452	—200 "	85.05	384.43
4,018			3,600.25

2,114 pounds, or 52.61 per cent. of the total concentrates, was thus recovered in the form of crucible flake, while the No. 2 and No. 3 grades were both of extremely high carbon content. The percentage of recovery was 76.41, and the average carbon content of the different sizes of product 89.6 per cent.

Sufficient experimental work has now been done with frothing oil flotation to demonstrate that the process offers probably the cheapest and most efficient means of producing high-grade graphite concentrates that has yet been devised. As with any other method, adaptation of the process to the particular ore to be treated is essential for best results, and certain ores may be treated with greater facility and better results than others. The fact, however, that flotation has given good results on graphite ores from Alabama, New York and on various types of Canadian ores, shows that with adequate care, the process is adaptable to graphite ores in general.

One of the important questions in connection with the milling of flake graphite ores is that of the most suitable methods of freeing the flake of attached gangue. Since it is of paramount importance that the natural size of the flakes be preserved as far as possible, consistent with clean separation, it is essential for maximum efficiency that the flakes be removed from the action of the grinding machine as soon as they are freed. A great variety of grinding machines are in use, including stamps, ball or tube mills, rolls, chasers, etc. Much depends on the nature of the ore as to the type of grinder to be employed, some ores being weathered and friable, as, for example, those of Alabama and Pennsylvania, while others are relatively hard and difficult to break, as is the case with the New York and certain Buckingham (Quebec) types. Some ores are gneissic in character and may be quite siliceous, while others are represented by graphitic crystalline limestones. For the above reasons, one type of grinder may obviously be better adapted to the ore of a particular district than another.

The grinder probably in highest favor at the present time for hard gneissic ores, such as are found in the Buckingham district, Quebec, is the ball or pebble mill, grinding being wet, this permitting the flakes to float as soon as freed and removing it from the action of the machine. Employing oil flotation, the oil may conveniently be added to the charge in the mill, thus grinding the ore and emulsifying the pulp in the one operation.

Wet grinding by any type of machine is far preferable to dry grinding, owing to the great amount of dust produced by the latter method. Much fine dirt adheres to the flake made in dry grinding and passes over with it, while in wet grinding the tendency is rather to wash the flake free of such dirt. It is also claimed from microscopical examination of the flake made by the two methods* that the original flake form of wet-ground graphite is preserved far better than that of dry-ground.

While it has been definitely established that oil flotation offers a ready means of producing refined graphite from its ores, the important question remains whether the refining can be made profitable. A flotation plant has the merit of being relatively cheap both to install and to operate as compared with many of the processes heretofore employed. Preliminary drying of the ore is dispensed with, power consumption is lower and fewer men are required for running the mill than is the case with most of the other methods. Better extraction is also possible, a percentage of recovery of 75 being readily obtained; with manipulation, this can in many cases be raised to 90 or better. Few of the methods in previous practice have averaged much over 50 to 60 per cent. recovery. With oil flotation, therefore, the number of pounds of flake recoverable per ton of ore treated is greater, and the cost of production per pound is as low, if not lower, than by almost any other method.

Comparative Costs of Operation.

Cost estimates for a mill treating 100 tons of Alabama graphite ore per day by oil flotation show that mining and milling costs amount to about $2.25 per ton of ore treated. This ore carries only 3 per cent. of graphite, of which about 2½ per cent. is figured as recovered; so that each ton of ore would yield 50 pounds of graphite of all grades, at a cost of nearly 5 cents per pound. Electric power is available in this district, the power consumption being figured at 150 H.P., and the cost at 37½ cents per ton of ore treated. Mining costs are considerably lower than would be the case in Canada, since the ore is soft and quarry methods can be employed. On the other hand, the better grades of Canadian ore carry four to five times as much graphite and the flake is larger, so that the yield of No. 1 flake per ton of ore would be very much higher.

It should be borne in mind that the successful operation of a graphite mill must depend essentially upon the output of the No. 1 size (20 to 90 mesh) flake, the smaller mesh sizes being merely accessory. The market for the No. 2, and more especially, the dust grade, is a very fluctuating one, and there is often difficulty in disposing of these products at any price. If, therefore, profits cannot be made on the output of No. 1 flake, it is bad policy to figure on covering the margin by the No. 2 and dust grades.

The question of whether Canadian flake graphite can be produced at a profit is one that depends so largely upon foreign supplies that it is difficult at the present juncture to hazard an opinion. The crucible trade is estimated to

*See Can. Min. Journ., March 26, 1919, p. 197.

consume in the neighborhood of 75 per cent. of the world's total graphite production, and this industry is supplied, at any rate in the Allied countries, mainly from Ceylon and Madagascar. Each of these countries has an annual output of between 30,000 and 40,000 tons of graphite, the bulk of which goes to Great Britain, France and the United States. While the price of crucible graphite rose to an unprecedented level during 1917 and 1918, Ceylon plumbago going as high as 30 cents per pound ex dock New York, and No. 1 flake selling at 16 cents per pound, this state of affairs has now changed materially. Removal of war risk insurance and reduction in freight rates has brought the price down very considerably, and while the pre-war level is unlikely to be reached, owing to the general rise in price of commodities all over the world, there is every probability that prices will go still lower than they are at present. Latest quotations for Ceylon plumbago and flake graphite on the New York market are as follows:

Ceylon Plumbago.

No. 1 Lump	13 to 13½	cents per pound
No. 1 Chip	10½ to 11	cents per pound
No. 1 Dust	7½ to 8	cents per pound

Domestic Flake Graphite.

No. 1	9	cents per pound
No. 2	6	cents per pound
Dust	1½	cents per pound

Factors in Foreign Markets.

The bulk of the Canadian graphite production has for a number of years past found a market in the United States, where the crucible grade, in common with the American domestic production, comes into competition with Ceylon plumbago and imported flake. Graphite enters the United States free of duty. American producers have lately been active in agitating for the imposition of a duty on imported graphite, recognizing that it will be difficult to meet the competition of Ceylon and Madagascar once normal trade conditions are re-established. A bill providing for such a tariff was introduced in Congress on June 16th, 1919, and is at present (June 25th) awaiting consideration by the Committee of Ways and Means. The bill provides for the following rates of duties:—

Crude ore, crystalline or amorphous, containing not more than 50 per cent. carbon	1 cent per pound
Crude ore, crystalline or amorphous, containing over 50 per cent. carbon	2 cents per pound
Plumbago, lump and chip, over ¼ inch mesh	3 cents per pound
Flake graphite, concentrates and refined, less than ¼ inch mesh	6 cents per pound
All manufactures of graphite	5 cents per pound

At the present time, the Canadian and American graphite industries are on a par as regards the problems immediately confronting them, and the conditions that affect the one similarly concern the other.

The opinion has been expressed to the writer by prominent New York graphite importers, that in order to meet foreign competition when trade conditions return to normal, Canadian (and American) No. 1 flake graphite will have to be produced at a figure not exceeding 5 to 6 cents per pound.

Another factor that affects the situation is the growing tendency in the metallurgical industries to introduce electric furnaces for melting steel and alloys. The number of such furnaces in the United States has increased greatly in the past few years, with consequent diminution in the quantity of crucibles used.

The question of developing an export trade in Canadian graphite to Great Britain and Europe generally has been considered, but the present is hardly an opportune time to take any steps in this direction. It seems doubtful, however, in view of the much higher cost of production in this country, whether Canadian graphite can hope to compete with the Ceylon and Madagascar product in the European market. Samples of No. 1 Canadian flake submitted by the Mines Branch to British crucible firms appeared to arouse little interest, present stocks of graphite being entirely adequate to meet the demand.

Uses of Graphite.

With the growing demand for graphite products, probably one of the best opportunities for profitable operations lies in the manufacture of such products by the refiner of graphite, as, in this way, all of the grades made can be utilized on the spot. Much of the natural graphite consumed in this country goes into foundry facings, lubricants, paints and stove polish, all articles that require no excessively costly equipment to manufacture and on which far greater profits might be realized than on the graphite entering into them as a raw material.

According to data collected by the Mines Branch* the total annual consumption of graphite of all grades in Canada in 1912-13 was just under 1,000 tons. Of this amount, only one-fifth was domestic, the remainder being imported. The bulk of the graphite used at that time went into foundry facings, stove polish and paints. The number of industries using graphite has been increased since the above survey was made by at least three, namely, dry battery, crucible and pencil. The first-named uses chiefly artificial graphite produced at Niagara Falls, Ont. In crucibles, both domestic and imported graphite is used, and in pencils, imported amorphous graphite.

Prior to 1915, a certain amount of Ceylon plumbago was imported for use in the best grades of foundry facings, but the trade at the present time uses chiefly Mexican, Korean, American and domestic graphite.

The paint trade uses both artificial and imported amorphous graphite.

Both flake and amorphous graphite is employed in lubricants. In addition, the Acheson Oilday Company, at Sarnia, Ont., manufactures so-called "de-flocculated graphite"—a very finely divided artificial graphite—for use in their lubricating compound.

The Dominion Crucible Company, with plant at St. Johns, Que., commenced operations in 1916, and is the first works of the kind to be established in Canada. The output of this plant has been confined to date to special order crucibles and accessories, but it is reported that the intention is to enter the market in competition with English and American makers. At the present time, the bulk of the crucibles used in Canada are believed to be of English manufacture.

*See H. Frechette, Report on the Non-Metallic Minerals Used in the Canadian Manufacturing Industries, Mines Branch Report No. 305, 1914.

Mr. Wendell H. Lawson, who recently started business in Colborne Street, Toronto, as a broker in oils, chemicals and industrial raw materials, has moved to larger offices, 30 Front Street West. Mr. Lawson is a young man who sees a large prospect in the chemical industries of Canada, and he is devoting his whole energies to this field of business.

Determination of Zinc and Calcium in the Presence of Lead

By ERNEST NYMAN*

As far as the writer knows, chemical literature does not mention the property of lead ferrocyanide and lead oxalate of being soluble in ammi acetate solution, neither the possibility of titrating zinc in ammoniacal solution, using uranylacetate weakly acidified with hydrochloric acid, as outside indicator. Methods based on these facts are outlined in the following and may prove useful, particularly in determination of zinc, calcium and lead in paint pigments, where these elements are apt to be present together. In the work, the writer has also proved the relation of the zinc salts precipitated by pot.ferrocyanide in acid and ammoniacal solution and the different factors for zinc in acetic acid solution and in a solution weakly acid with hydrochloric acid.

Determination of Zinc.

To the acid solution of the salts, add NH_4OH till strongly ammoniacal, then make acid with acetic acid, and if a precipitate still remains, add a few grams of amm. acetate, heat to boiling, remove from heat, make faintly ammoniacal, and add some $K_4Fe(CN)_6$ solution. The zinc is precipitated as normal zinc ferrocyanide $Zn_2Fe(CN)_6$, the lead remains in solution, lead ferrocyanide being soluble in ammonium acetate. Neither does Ca interfere.

If, when adding NH_4OH to an acetic acid solution, no precipitate forms, it may indicate either absence of lead or an amount that is soluble in the amm. acetate formed.

In this way, zinc may be determined qualitatively, as above, as well as quantitatively, as follows:—

Proceed as above till the faintly ammoniacal solution is obtained, arrange the temperature of the solution to be 70—80 deg. C., add, dropwise, standard $K_4Fe(CN)_6$, stirring thoroughly and spotting the endpoint by the usual reddish-brown tinge developed with uranyl-acetate on a spotplate, the spotting modified, as will be indicated in the following:

This tinge is caused by a faint precipitate of $(UO_2)_2Fe(CN)_6$. In titrating a weakly acid solution, this tinge appears, as known, when a drop of the solution comes in contact with a drop of the uranyl-acetate solution on the spotplate.

This is not the case when the solution titrated is ammoniacal, because canary yellow, amorphous ammonium uranate is precipitated by the NH_4OH.

$$2UO_2(CO_2CH_3)_2+6NH_4OH=(NH_4)_2U_2O_7+CH_3CO_2NH_4+3H_2O$$

No reddish-brown tinge is thus developed, also because the $(UO_2)_2Fe(CN)_6$ possibly formed, is soluble in the ammonium uranate:

$$(UO_2)_2Fe(CN)_6+6NH_4OH=(NH_4)_4Fe(CN)_6+3H_2O+(NH_4)_2U_2O_7.$$

But adding a drop of HCl solution, say (1:12), to the uranylacetate drop on the spotplate, before titrating, will neutralize any free ammonia, and then the ferrocyanide acts with the acetate forming the reddish-brown tinge.

Also, it must be remembered that in an ammoniacal solution normal zinc ferrocyanide $Zn_2Fe(CN)_6$ is precipitated, while in an acid solution this salt is first precipitated, but by adding more of the ferrocyanide gradually changes, giving as a final salt a precipitate of pot. zinc ferrocyanide $K_2Zn_3[Fe(CN)_6]_2$.

Thus, in an ammoniacal solution, a salt containing 1 g. of zinc is precipitated by 3.2304 g. of $K_4Fe(CN)_6\,3H_2O$ $\left(\frac{422.35}{65.37\times 2}\right)$ the equation being:

$$2Zn(CO_2CH_3)_2+K_4Fe(CN)_6=Zn_2Fe(CN)_6+4KCO_2CH_3$$

while in an acid solution, the same amount of zinc is precipitated by 4.3073 g. of ferrocyanide $\frac{(422.35\times 4)}{(65.37\times 6)}$, the equation being:

$$6Zn(CO_2CH_3)_2+4K_4Fe(CN)_6=2K_2Zn_3[Fe(CN)_6]_2+12\,KCO_2CH_3.$$

The theoretical factor for converting the zinc value of the ferrocyanide solution obtained in acid titration, to its zinc value in ammoniacal titration thus being $\frac{4.3073}{3.2304}=1.3333$.

The practical factor as arrived at from determinations (see below) carried on by the writer is 1.3450. The difference between the factors is satisfactorily small and is to be attributed to some unavoidable experimental cause, may be, partly, to a difference in sensitiveness of the external indicator to an acid and ammoniacal titration. This being the case, it may be stated that the zinc salts precipitated in ammoniacal and acid solution are identical with the zinc salts of respective formulas, $Zn_2Fe(CN)_6$ and $K_2Zn_3[Fe(CN)_6]_2$. This corrects the statement found in the literature on the subject, which states that the zinc salts precipitated are not identical with zinc salts of these formulas, but fairly closely approach the identity.

From the determinations conducted, it also appeared that when titrating an acetic acid zinc solution for standardizing the ferrocyanide, a constantly lower value of zinc was obtained than when the titration was carried on in weakly HCl acid solution. But this discrepancy vanished and identical values were obtained if a drop of HCl was added to the uranyl-acetate drop on the spotplate. This shows that a larger excess of $K_4Fe(CN)_6$ is needed to give the reddish-brown precipitate in an acetic acid solution than in a HCl acid solution. This, also, is to be expected; the acetic acid solution being less ionized than the HCl solution. It seems, therefore, to be necessary, if only one standard ferrocyanide solution is to be used, to standardize this solution with a weakly HCl acid solution and when an acetic acid zinc solution is at hand to be titrated, either to make it ammoniacal and then weakly acid with HCl; or if the titration is carried on directly in the acetic acid solution to add a drop of HCl to the uranylacetate drop on the spotplate.

The standardization of the pot. ferrocyanide solution in an acetic acid and ammonical zinc solution with the object of determining the factor for converting the value on zinc obtained in an acid solution to the value on zinc for titration in an ammoniacal solution was carried on as follows:

0.20—0.25 g. of C.P. electrolytic zinc were dissolved in 10 cc. conc. HCl, then 10 cc. H_2O added, the solution boiled for a couple of minutes, removed from heat, 20 cc. NH_4OH (1:1) added, 5 cc. conc. HCl added, the solution again boiled

*Received May 26, 1919. Chemical Laboratories, Milton Hersey Co., Limited, Winnipeg, Man.

for a couple of minutes, cooled and diluted to 250 cc. at standard temperature. Of this solution 25 cc. portions were pipetted off into 250 cc. beakers. If the object was to titrate in an acetic acid solution, the HCl acid zinc solution in the beaker was made ammoniacal to litmus then just acetic acid, 75 cc. water added, the solution heated to nearly boiling and the titration carried on at 70—80 deg. C., as described in an earlier article by the writer (Canadian Chemical Journal, Vol. II., No. 7), with the exception that a drop of HCl was added to 1 drop of the uranyl-acetate (4 per cent.) on the spotplate, before titrating.

The titrating in an ammoniacal solution was conducted in the same way with the only difference that the acetic acid solution was made slightly ammoniacal. In an ammonical solution also, the $Zn_2Fe(CN)_6$ precipitated is not flocculent, but more of a colloidal nature, it, therefore, not being possible to observe the endpoint, as the case is in an acid solution by the momentary complete change of the flocculent $Zn_2Fe(CN)_6$ first precipitated in an acid solution, into the colloidal, milky precipitate of $K_2Zn_3[Fe(CN)_6]_2$; it, therefore, being necessary always to use uranyl-acetate as an external indicator, when titrating in an ammoniacal solution, while an expert's eye can do without the same, when titration takes place in an acid solution. A set of the titrations done in acid and ammoniacal solution will show how the factor 1.3450 was derived:

0.2141 g. zinc/250cc solution. Taken 25 cc. portions.

Titration in acetic acid solution:

(1) 4.20 cc. of $K_4Fe(CN)_6$ used

(2) 4.15 "

(3) 4.25 "

(4) 4.20 "

Average 4.20 cc.; blank 3 cc.

1 cc. = 0.02141/3.90 = 0.005489 g. Zn.

In ammoniacal solution:

(1) 3.05; (2) 3.10; (3) 3.10; (4) 3.15.

Average 3.10 cc. of $K_4Fe(CN)_6$ sed. Blank. 3 cc.

1 cc. = 0.02141/2.90 = 0.007383 g. Zn.

The factor: 0.007383/0.005489 = 1.3450.

The precipitated zinc salt may be filtered off and the lead determined in the filtrate by the chromate method.

In this connection, it may be stated that, contrary to common opinion, the $PbCrO_4$ is to be dried at 100 deg. C. for 1 hr., the drying may be carried on in a couple of minutes by heating the $PbCrO_4$ in the Gooch, placed in another porcelain crucible, that may be exposed to the full heat of a Bunsen flame. Also heating the $PbCrO_4$ in the Gooch directly with a full Bunsen flame seems not to change its composition. The literature states the melting point of $PbCrO_4$ to be 971 deg. C.

Determination of Calcium.

Proceed as directed above for determination of zinc till the faintly ammoniacal solution is obtained, then add sufficient of a solution of amm. oxalate. Calcium is precipitated as oxalate, the lead remains in solution, lead oxalate being soluble in amm. acetate. Neither does Zn. interfere.

The lead may be determined qualitatively as well as quantitatively in the filtrate by the chromate method, although to determine it quantitatively the most convenient way is to first precipitate the lead as chromate, determining calcium in the filtrate, as oxalate.

PERSONAL.

We regret to learn of the resignation of Mr. B. Leslie Emslie, F.C.S., Supervisor of Investigational Work with Fertilizers, Dominion Experimental Farms System. Mr. Emslie joined the staff of the Division of Chemistry, Department of Agriculture, Ottawa, shortly after the outbreak of the war, and since the date of his appointment, under Dr. Shutt, Chief of the Division, has planned and carried out all the experimental work with fertilizers at the Central and Branch Farms and Stations of the system throughout the Dominion.

Mr. Emslie brought to his work a long and careful training and a ripe experience in experimental work with fertilizers, gained in Scotland and on the Continent. His resignation at this time from the post in which he has done such signal service for the country of his adoption will mean a great loss to the Dominion, for the value and importance of fertilizers in increasing crop yields is a matter which as yet is but faintly understood and realized by our farmers.

He has done excellent work, not only in the direction and control of fertilizer experiments and in the interpretation of their results, but in propaganda of the best order towards bringing before our farmers the rational and profitable use of fertilizers.

Mr. Emslie's position will be a difficult one to fill; we can only hope, in the interests of Canadian agriculture, that the Government may be fortunate in its choice of a successor. The best man available will be none too good.

Mr. T. Linsey Crossley, A.M.E.I.C., who has been associated for a number of years with Dr. J. T. Donald of Montreal, and who established the Toronto laboratory of J. T. Donald & Company, consulting chemists, has taken over the Toronto office and laboratory of that firm at 43 Scott Street, and will there carry on the business of consulting chemist and chemical engineer.

Mr. Crossley has specialized in municipal chemistry and the technology of pulp and paper manufacture.

Lt.-Col. Eric Phillips, M.C., D.S.O., is now with the Army of Occupation in Germany. He is a graduate of the class of 1914 (Chemistry), University of Toronto, and went overseas as a lieutenant with the Canadians, and was transferred to an Imperial Battalion, the Royal Warwicks, with whom he went into action. He was promoted to be Lieutenant-Colonel, and was awarded the Military Cross and Distinguished Service Order. He was wounded last year, and after recovery was home for a short while, later returning overseas.

Congratulations are extended to Professor Ernest L. Baker, of Western University, London, Ont., on his appointment to the Fellowship Board of the United States National Research Council for the advancement of fundamental research in physics and chemistry.

Captain Adam W. Sime, class 1914 (Chemistry), Toronto University, is being welcomed home by many of his old schoolmates. He went overseas in 1915 and was taken prisoner by the Germans, and for twenty-one months was interned in a German prison camp.

C. H. Wildridge, formerly with R. W. Hunt & Co., Montreal, has accepted a position as metallurgist with the Manitoba Steel Foundries at Selkirk, Manitoba.

Chemical Adventures in British Columbia*

By JOHN A. DAWSON, Chairman, Canadian Pacific Section, Society of Chemical Industry

The horizon hunger, the love of adventure, the demon of research, urges us under the seas, over the mountains, into the skies and ever farther into Nature's realm of unknown knowledge.

This insatiable spirit wafted the sails of Drake, Cook and Vancouver, far over the unknown oceans to the American Pacific coasts. The circle of the Globe was closed over the Canadian Rockies in the canoes of the fur traders, Mackenzie, Fraser, Thomson, McLoughlin and Douglas, pioneer explorers for the Northwest Fur Company and for the Gentlemen Adventurers trading into Hudson's Bay. Following the fur trader came the prospector with pack sack and pan, lured up the Fraser and along the Cariboo trail by the Golden will o' the wisp. Then came that indomitable scientist and explorer, George M. Dawson, carrying the search-light of knowledge handed on by Murray, Logan, and his father, William J. Dawson.

The next adventurers were the railway builders, such men as James J. Hill and Donald A. Smith, collaborating with John A. Macdonald, the Father of Confederation. The National Policy of John A. Macdonald protected and reared the early infants of Canadian industry, chemical and otherwise even as that same policy encourages and protects new industries to-day. Here let me quote a paragraph from the very first campaign address delivered by John A. Macdonald at the then town of Kingston, in 1844:

"I therefore need scarcely state my firm belief that the prosperity of Canada depends upon its permanent connection with the Mother country, and that I shall resist to the utmost any attempt (from whatever quarter it may come), which may tend to weaken that union."

Thus 75 years ago at the age of 29, our greatest Canadian statesman enunciated the keynote of our national destiny. Needless to say, this imperial policy has a fundamental influence on the organization of Canadian chemists.

The construction of the Canadian Pacific Railway insured British Columbia's entry into Confederation and the holding of the present Canadian Pacific coast for the British Empire. The "Bostonnais" had possessed the realms of Oregon, California and Alaska and the Battle cry '54-40 or fight' was still echoing in the coast mountains. In all our national development there is probably no more important adventure than the undertaking by these Empire builders to consolidate British North America, destined yet to be the greatest of the United States of the British Empire. Following the first twin bonds of railway steel between East and West, the ties have been extended to the North by William Mackenzie, Daniel Mann and others. Now the people of Canada have undertaken the great adventure of government ownership of practically every railroad in Canada except the pioneer Canadian Pacific system. As loyal Canadians and Chemists we must give our utmost support to the Government in this tremendous undertaking because our national success in chemistry and in all industry is reciprocally dependent upon an efficient system of transportation both internally and externally.

The development of steamship lines has progressed mutually with our railways. Now, the war has brought government ownership into this sphere of activity. Announcement has been recently made that the Cunard Line propose to establish ocean services from Vancouver to the Orient. Latest of all, the Canadian Pacific Railway Company have extended their Charter to operate airships.

Few parts of the world offer a greater range of opportunities and allurements than does the Province of British Columbia. With mountains lavish in minerals, forests and scenery; plateaus and valleys gorging with rivers, waterfalls and fertility; with an ocean coast abounding in islands, fjords and fish; with abrupt ranges of climate and altitude; with eternal glaciers pouring out purest fresh water and the trusty tides rolling up the fresh cleansing salt water, with westerly ozone air from ocean, forest and mountain; with the service of five transcontinental railroads from the Canadian prairies and the United States; with steamship lines to California, Panama, Australia, China, Japan, Manchuria and Alaska; and inheriting all this a hardy, adventurous people of emphatically British origin, ideals and patriotism—who can foresee the limits of our future?

With a total population of some 350,000, over half of whom live in greater Vancouver, may we not be permitted just pride in our war contributions? In all Canada we built the largest steel and wooden ships and proportionately more per capita; supplied more airplane spruce than even United States, produced large quantities of steel shells, electrolytic copper, zinc and lead; furnished coal for the United States navy; refined great quantities of petroleum oils and whale oils for glycerine; manufactured our own sulphuric and nitric acids for trinitrotoluol; evaporated vegetables and milk for the army including that of United States; canned salmon and even whale meat;

The "Twin Lions," on the Britannia Range, B.C.

and imported immense quantities of trans-Pacific products especially food and labor. Latterly as Food Controller for Canada was our Mr. Thompson. We spared of our best seamen for the motor boat patrols and the grand fleet; in the air force was our Collishaw; in charge of the allied railway construction in France was our General Stewart; at the battle front were our Leckie, Bell Irving, Odlum and lamented Hart McHarg; and as Commander in Chief of all the Canadian forces in France was our General Currie and with him our real fighting men unequalled in resourcefulness, daring and determination.

It is with particular interest that I now refer to the achievements of our pioneer group of chemists—Mr. Noble W. Pirrie as Director of Explosives in Canada for the Imperial Munitions Board; the original industrial research of members of the staff in Chemistry of the University of British Columbia; Mr. Berkeley's investigations at the kelp-acetone plant of the Hercules Powder Company at San Diego, California; Mr. Freeman's discoveries while in British Columbia of cyanogen derivatives from cyanamide; the necessary routine, control and inspection of food and munition supplies; the assaying, smelting and refining

*An address delivered at second convention of Canadian Chemists, Montreal, May 17, 1919.

of ores; and greatest of all the extraordinary production of high explosives at James Island by the chemists of the Canadian Explosives Limited acting under the direction of Mr. F. Moore and Colonel Hall. In all this we would pay due tribute to our home people especially in Eastern Canada and in Great Britain, who before the war sent to us freely of their best and most adventurous.

In the business ventures now to be considered, chemistry is of fundamental interest and their success depends upon the presence of or easy access to sources of raw material. British Columbia is supremely unique in the quantity and quality of its mineral deposits. Copper, zinc, lead, silver, gold, iron, manganese, chromium and sulphur, with such rarer elements as platinum, molybdenum, cobalt, arsenic, antimony, tungsten, mercury, and others, have all been recovered in greater or less quantity. Recently there have been large investments of Cobalt capital in British Columbia mines. Only the barest surmises can be made of the extensive deposits of coal, natural gas, petroleum, limestone, magnesite, gypsum, talc, fluorite, mica, granite, marble, slate, sand, clay and building stones.

The value of mineral production in British Columbia for the fiscal year 1918–1919, as compared with the previous year, is estimated as follows, in millions of dollars—

	1918–19	1917–18	Difference
Copper	15.7	16.0	—0.3
Coal	11.5	7.5	+4.0
Coke	1.3	0.9	+0.4
Gold	3.6	2.8	+0.8
Lead	2.9	2.9	0.0
Silver	2.6	2.3	+0.3
Zinc	2.5	3.2	—0.7
All others	1.0	1.2	—0.2
Totals	41.1	36.8	+4.3

This shows an increase of 4 million dollars mineral production in British Columbia, while decreases were shown in six adjoining States.

The Consolidated Mining and Smelting Company at Trail, under Canadian control, have the only plant in the world that refines five metals electrolytically, namely: lead, zinc, copper, gold and silver. A daily production of over 60 tons of pure zinc was reached. An extraction of 90% or more was made from certain classes of ore. Last year 10,000 tons pure zinc of value $3,000,000 was produced. In addition, sulphuric acid from roasting sulphide ores, manganese, copper sulphate, hydrofluoric acid, hydrofluosilic acid, as well as sufficient copper wire and rods to supply the Canadian market, are produced. Recently the Assistant General Manager has announced that employees of the company will be encouraged to purchase a $3,000,000 issue of bonds under easy terms.

The Britannia Mining & Smelting Company on Howe Sound, 27 miles from Vancouver, work the largest copper mine in the British Empire, there being some 40 miles of underground development. This was the first mine in Canada to install an oil flotation plant for concentrating low grade copper ore. Recently the character of the ore changed and the tailings loss increased from about 0.1% to 0.5% (Cu.) As a result of considerable previous experimentation, one of the members of our Local Section was able to supply a new oil of local production that immediately reduced the loss to its original percentage of 0.1% Cu. The concentrates mainly in the form of chalcopyrite containing zinc, gold and silver, are shipped to the smelter at Tacoma, Wash.

The Granby Consolidated Mining & Smelting Company have produced over half the copper of British Columbia. They operate a number of mines, the Hidden Creek mine being second only to the Britannia in development. The Smelter at Grand Forks with a capacity of 4,000 tons a day is the largest in the Empire. The Smelter at Anyox has a capacity of 3,000 tons per day. The annual production of copper is from 40 to 50 million pounds. The product of the smelters is shipped to the Nichols Copper Company of New York for refining.

Many of the mines of British Columbia yield complex lead and zinc sulpide ores and the recovery of all the metal values has been a difficult smelting problem. The French's Complex Ore Reduction Company, whose debentures are guaranteed by the British Columbia Government, have an experimental plant at Nelson for the electrolytic treatment of these ores. The work is in charge of Mr. Thos. French, one of the original members of our section of the Society of Chemical Industry.

It is estimated that the known deposits of coal in Canada contain one million two hundred thousand millions tons, which is more than that in all the rest of the British Empire together. More than half the tonnage of Canadian deposits is in British Columbia. The character ranges from anthracite to lignite, but by far the greater part is high grade bituminous, much of which makes excellent metallurgical coke. At Cassidy on Vancouver Island, the Granby Consolidated Mining & Smelting Company have recently opened a new coal mine. Coal will be shipped to the Anyox smelter where 30 by-product ovens of the latest type with a total maximum capacity of 300 tons per day, have been installed. These will commence operations next month and benzene, toluene, tar oils and pitch will be recovered. In association with this, the Barrett Company at Marpole on the Fraser River, near Vancouver, are erecting a large creosoting and roofing materials factory. The Granby by-product coke ovens are the first to be erected in Western Canada. Recently the British Columbia Sugar Refinery have installed powdered coal blowers to replace the fuel oil burners.

The manufacture of coke should soon lead to the successful solution of producing iron from the extensive deposits of magnetite, estimated as millions of tons, that are exposed particularly on the islands along the coast. The British Columbia Government are offering a bounty of $3.00 per ton on pig iron produced from native ores. They have also arranged to supply ten thousand tons of magnetite for the purposes of experimentation. Dr. Stansfield of McGill University has investigated the possibilities of electro-smelting and concludes that the process is economically possible provided sufficiently cheap hydro-electric power is supplied. Two firms have already made application for 5,000 tons each of magnetite ore, one using an experimental electric furnace and the other a blast furnace with auxiliary fuel oil burners. The outcome of these semi-industrial investigations will be followed with great interest especially on account of their effect on the future of the steel ship-building industry on all the Pacific coast.

Since the chief source of the world's supply of tin is in the East Indies, the most economic location for the manufacture of tin plate to supply the immense local demand for cans for the fish, vegetable and milk canning industries, is on the Pacific coast, whether the iron plate necessary be brought from Eastern America or Asia or eventually be manufactured from British Columbia iron ores.

Three factories manufacturing babbit, solder, and type metal have recently been established and the manufacture of brass, bronze and other alloys is being extended.

Petroleum oil is imported principally from the Peruvian fields and refined at the Ioco plant of the Imperial Oil Company and at the plant of the British Columbia Refining Company. Exploration for oil is being vigorously prosecuted east and south of Vancouver. The Darcy Exploration Company of London, England, two-thirds of whose stock is controlled by the British Government, own the immense Anglo-Persian oil fields. This syndicate has offered to spend up to several millions of dollars drilling an area 60 miles square in the Peace River country of British Columbia taking a five years lease and paying 12½%

royalty to the Government and constructing a pipe line across the Rockies to the Pacific ocean if oil is found in sufficient quantity. This would furnish a supply of fuel oil for the North Pacific squadron of the British Navy. The Department of Lands of the British Columbia Government, under the Honourable Mr. Patullo, propose to spend up to $50,000 to explore for gas and petroleum in British Columbia.

As yet there are very few industries in British Columbia that use metals from the local smelters and refineries for the manufacture of chemical products. Early in the war Vancouver interests erected a plant for the manufacture of white lead, using lead metal from the Trail refinery. The project failed owing to incompetent technical supervision. The Pacific White Lead Company, a branch of the Brandram-Henderson firm, was then established on Industrial Island, Vancouver, and is still operating. The opportunity of establishing extensive lead, zinc, copper, iron and chromium pigment manufacture is obvious.

In British Columbia there are a number of lakes that contain magnesium sulphate with varying proportions of sodium sulphate. Most of these dry up in the summer and the salts can be easily recovered. Near Ashcroft, the Basque Chemical Production Company own a group of five lakes from one of which a considerable tonnage of practically pure epsom salts has been stored for shipment to tanneries and for veterinary use. Plans are being considered for a plant to produce B.P. salts for the drug trade. The composition of the salts from a second of these lakes is such that an excellent mineral water can be obtained to replace those imported from Hungary before the war. From an alkaline lake near the Pacific Great Eastern a considerable tonnage of sodium carbonate has recently been separated.

Time will not permit more than mention of the cement, lime and ceramic industries, all of which are rapidly expanding. Preliminary work on the production of calcium carbide is being carried out by the Pacific Smelting Company at Edmunds, B.C. Another firm is erecting a large carbide factory on Vancouver Island, B.C. Oxygen for Oxy-acetylene welding is supplied by the Compressed Gas Company of Vancouver, using the electrolytic method, the hydrogen going to waste. Announcement has recently been made of the proposal of the Societe pour l'Air liquide to establish a large plant in Vancouver. The Canadian Carbonate Company also propose to erect a carbon dioxide plant. The American Nitrogen Products Company of Seattle are installing an air nitrate plant beside the Lake Buntzen hydro-electric powerhouse of the British Columbia Electric Railway, using the excess energy when peak load is not required. During the war, the Vancouver and Victoria Gas Works recovered ammonia to supply the local explosives works with ammonium nitrate. The total production of trinitrotoluol in British Columbia is reported to be over 20 million pounds, the rate at the last being 1,600,000 pounds per month. More than one-third of the war production of Canadian T.N.T. was produced in British Columbia. The nitre cake residue from nitric acid manufacture was utilized in part after treatment, by the sulphate kraft paper mills.

The chemical pulp and paper industries of the Pacific coast are expanding with phenomenal rapidity. No by-products are recovered as yet. The waste liquors go into the ocean. Michigan interests will shortly open a new paper mill at which it is proposed to treat the waste bark for tanning extract. Experiments have been made by several concerns on the destructive distillation of wood including mill waste but no permanent results have followed. In one case the retort was equipped with an internal electric heating unit.

Last season the Consolidated Whaling Company took 999 weales, supplying great qnantities of oil for munitions purposes. The meat of the Sei whale was canned for foreign trade. Recently a plant has been set up to extract liver oil from dog fish, the waste being dried for fertilizer or feed. Morton Gregory of the Western Rubber Company of Tacoma is utilizing fish waste for the manufacture of an excellent rubber substitute. (U.S. Patent, Serial No. 83,815, filed March 13, 1196). Dr. H. K. Benson, professor of Industrial Chemistry at the University of Washington has reported on various products made under this patent. He states that there are several forms of the base substitute costing from 4 to 11 cents per pound, and that the use of this substitute reduces the cost of manufacture some 27 per cent. There is also a local advantage of 10% over the eastern manufacturer on account of saving of freight, since 75% of United States and 90% of Canadian import rubber coming as it does from East Indian plantations enters by Pacific ports. Sulphur and other chemicals are easily accessible. A branch of this Tacoma firm has just been established in Vancouver, known as the Gregory Tire & Rubber Company. Mr. Firestone and Mr. Ford, at a recent banquet at Los Angeles predicted that the rubber industry of United States would be transferred eventually to the Pacific coast. One of the important causes of this is the long fibred character of the cotton grown in Imperial Valley, California. This predicted migration of the rubber industry is similar to that of the New Englanp textile factories to the cotton plantations of the southern states.

One or two adventures in chemical organization may be of some interest. Some three years ago we commenced the organization of our local section of the Society of Chemical Industry. That we are Canadian is indicated by our name, "Canadian Pacific," and of course our first name is British, "British Columbia." Between you in the East and us in the West, there are almost 3,000 miles of mountains, prairies and archaean rocks. We follow with great interest the evolution of our mutual problems and look forward to the day when you who hold the balance of power shall have worked out an acceptable democratic scheme for our national organization within the Empire. Possibly, we shall have to await the outcome of the rapprochement of the diverse, overlapping organizations of chemists and analysts in Great Britain. Is it too much to hope that some day soon we may have one Empire-wide British Chemical Society? Surely not, when we see the formation in Britain of a Joint Council for Pure and Applied Chemistry and following this, a meeting held in Paris for the purpose of forming a chemical alliance, at which British, French and United States representatives were present. Definite action has been taken to compile for the English-speaking nations, chemical lexicons for organic and inorganic divisions. Co-operation in the joint publication of abstracts is also under consideration. If we in Canada are to take any part in these activities, it is necessary that we develop some form of consolidated national organization which we trust may be unanimously decided upon with least possible delay.

Last February in Vancouver, at a meeting representative of various classes of engineers, architects, chemists, etc., first steps were taken towards the formation of an alliance now known as the British Columbia Technical Union. The general purposes of this alliance are—

(1) To obtain adequate public recognition of technical work.

(2) To establish scales of minimum fees for consultants and obtain recognition of the same.

(3) To obtain equitable remuneration for salaried technical men and their salaried technical assistants.

(4) To secure the consultation and employment of local members of the technical professions for work in British Columbia and to discourage the importation of men for technical work when duly qualified men are available in the province.

(5) To protect members of this Society when handicapped by extraneous influence in the execution of their professional duties.

(6) To co-operate with existing professional societies in furtherance of the above objects, and while not interfering with their usual activities, to assist them in every legitimate manner which

will tend to maintain or improve the efficiency, status and remuneration of the technical profession.

(7) To protect the public by encouraging the employment of qualified technical men.

(8) Generally, to take any further action deemed necessary to advance the interests and usefulness of the Union.

The following facts indicate the necessity of professional protection. The States of Washington, Oregon and California have legislated against non-resident architects practising within their borders. Yet architects from United States are employed in British Columbia and in one recent instance by those who publicly support a propaganda of "Buy Goods manufactured in British Columbia." Yet these very same local loyalists do not extend the principle to "Buy Brains living in British Columbia." Similar cases might be quoted for other unprotected professions. In British Columbia, assayers cannot practise without obtaining from the Provincial Government an assayer's certificate which does not by any means involve an outlay of capital for a University diploma. Occasionally, near chemists extend their activities to other forms of chemical analysis, often with disastrous results to their clients and to the reputation of qualified chemists. These pseudo-chemists frequently cause considerable unnecessary expense as in the case where some 35 per cent. of potash was reported in the evaporate from the saline water of a lake near Edmonton, Alberta, with the consequence that a syndicate was organized and very considerable capital expended towards the development of the project before the error was detected. The so-called explanation offered was that perchloric acid had been used on account of the high price of platinum. The probability is that the analyst was not qualified to make the analysis and probably was forced to work under sweat shop conditions as is often the case. The chances that such serious errors be made, would be greatly decreased if every analyst was legally required to invest in a course of training such as is required of the legal, medical or other expert, who must satisfy legal professional requirements.

The British Columbia Government have established a new Department of Industries, the powers of which are to provide for industrial research, acquire knowledge already existent, survey natural resources, furnish advice on the solution of industrial problems, publish scientific information, initiate scientific researches, to aid by loan any commendable enterprise aiming to develop natural resources and generally to assist with the settlement of returned soldiers and development of the province. If this work is to be carried out with thoroughness commensurate with the opportunity for it, there will be required a considerable corps of qualified chemists and other technical men.

We as chemists who possess most knowledge of the great principles that control transmutations of matter and energy, have more than ever before, great opportunities to serve our fellow men. The experience of the war has demonstrated that the Canadian chemist as the Canadian soldier has indeed inherited the magnificent spirit of adventure from those who first sailed the unknown oceans or blazed the trails through the wilderness to the farthest outposts of the Empire.

I feel it a great honour to have had the opportunity to address you as a representative of the adventurous chemists of the farthest west. If I have appeared to boast unseemly of our modest achievements in British Columbia, I know that my exuberance will be pardoned once you see our scenery and breathe our air. We hope that soon the Canadian Pacific Airplane system will be so developed, that we may have the great privelege of entertaining our fellow Canadian chemists at an Annual Convention on our Pacific coast.

And when you are "zooming" down through the Pacific empyrean, you will behold 6,000 feet high on the horizon over the Britannia range, the Twin Lions couchant, sculptured by Nature from the eternal granite. According to the traditions of the Indians, as described in Pauline Johnson's "Legends of Vancouver," these peaks were known as the Twin Sisters raised by the Siwash Indians' God, Sagalie Tyee, to celebrate a feast of peace when the twin daughters of a great chief reached their majority. White men have titled them "The Sleeping Lions," but we prefer to feel that they represent a mundane, seismic incarnation of the spirits of the mother British Lion and of her lusty Canadian Cub, faithfully presiding over our British destiny.

I would express my gratitude to fellow members of the Canadian Pacific Section of the Society of Chemical Industry for interesting information; to the Natural Resources Department of the Canadian Pacific Railway for the loan of the magnificent series of coloured lantern slides; and spiritually to our adventurous Canadian Penates for their inspiring example.

SYNTHETIC AMMONIA AS A SOURCE OF FERTILIZERS IN GERMANY.

The Badische Company has devoted much attention to the transformation of all of its synthetic ammonia salts suitable for agricultural purposes. After meeting with considerable difficulties, it has successfully solved the problem of the manufacture on a very large scale of the following salts: Sulphate, chloride and nitrate of ammonium, ammonium-calcium phosphate, and a mixture of calcium nitrate and urea.

The sulphate is prepared either by direct neutralization of sulphuric acid, or by double decomposition of ammonium carbonate and gypsum, or by the decomposition of ammonium bisulphite into sulphate, sulphuric acid and sulphur, thereby eliminating the necessity of transforming SO_2 into SO_3.

The calcium-ammonium phosphate is prepared by the absorption of ammonia gas by superphosphate.

Badische also recommends the preparation of a mixture of urea and calcium nitrate, which is not deliquescent, like calcium nitrate alone. The urea is obtained from carbamate.—Chem. Ztg., Vol. 42, No. 49, April, 1918, through Chimie & Industrie, Vol. I., No. 5, Oct., 1918.

PROTEST NATIONALIZATION OF DYE INDUSTRY.

The employees of the Farbenfabriken, Vorm, Friedrich Bayer & Co., Germany, numbering more than 2,000, have sent a telegram to Chancellor Ebert stating that an eventual nationalization of the dye and drug industry would bring enormous harm to Germany. They state that Germany's chemical industry owes its dominant position in the world markets to the speculative chemical investigations extending through many years, the tireless technical labors in the factories, and the energy of the German salesmen abroad. A nationalization of these establishments would be the most radical and the surest means to ruin them in the shortest time possible, the telegram stated.—From The Board of Trade Journal, London, Eng.

BOARD OF CUSTOMS DECISIONS.

File No. 95400.—Tariff status of silver alloy ingots, per sample, composed of silver, tin, copper and zinc, for dental purposes, imported by the L. D. Caulk Co., Toronto, declared to be dutiable under tariff item 711.

File No. 97412.—Silver alloy in powdered form, per sample, composed of silver, tin, copper and zinc, declared to be dutiable under tariff item 711.

The Work of the Canadian War Mission at Washington from the Standpoint of the Chemist*

By J. WATSON BAIN

THERE are few among us who realize the extent of our dependence in an economic sense upon the United States, and it is a good thing to look at the situation with a view to possible industrial developments in Canada.

Until some time after the declaration of war, in April, 1917, the United States was the happy hunting ground of the purchasing agents for the Allied Governments. The great stores of raw materials within her borders, and the immense manufacturing facilities which she possessed enabled our neighbor to furnish to Europe the supplies which were so urgently required with the result that the rest of the world came to the conclusion that anything could be bought in the United States if one had enough money. You have all heard of this industrial expansion, and many of you have, no doubt. seen some of the new factories which sprang up like mushrooms all over the country; for chemists the tale is written on nearly every piece of apparatus in the laboratory.

When the Unied States commenced preparations for war, it was realized that in spite of the extent of her resources, there might not be enough war materials to meet the needs of other warring nations in addition to the domestic programme. The consequence of this was the establishment of a system of government control of many raw materials and manufactured articles which may be said to date roughly from the end of 1917. The agencies through which this control was exercised were four in number and their functions were briefly as follows:

The War Industries Board had control of a great many of the industries, in some cases fixing the selling prices of the products or restricting the use of scarce raw materials. In the iron and steel industry the products could only be sold to certain purchasers who secured the goods in the order of the urgency of the case by a system of priorities. The War Industries Board was charged with the duty of advising and assisting the War and Navy Departments, in connection with the purchase of their supplies, and with the further duty of aiding the Allies to obtain war materials if a surplus were available for export. Although perhaps not intended originally, the War Industries Board was the dominating influence in the control of trade activities, and frequently the disappointment of a Canadian buyer over the refusal to permit the export of his purchases could be traced to activity of an official of the War Industries Board. Still another and a very important function of this Board was the stimulation of the production of both raw materials and manufactured goods.

The War Trade Board was charged with the regulation of imports and exports which was effected by a licensing system. Whenever it was considered necessary in connection with a specific article, the Board issued a regulation requiring the issue of a license before the article could be brought into or shipped out of the country. As a result of this action, any scarcity in the supply of an article in the United States was immediately reflected by a difficulty in securing an export license, while on the other hand, if there was an abundant domestic supply, trouble arose in obtaining an import license. The War Trade Board had on its staff many men who were familiar with the industries whose products were placed in their care, and this intelligent handling of difficult questions prevented the restrictions from becoming intolerable. From what has previously been said regarding the War Industries Board, it will be obvious that the War Trade Board had to be guided in many of its activities by the advice of the former, which was in close touch with the domestic situation.

Formation of the War Mission.

We can now turn to the Canadian War Mission. Towards the end of 1917, Mr. Lloyd Harris, president of the Russell Motor Car Company, Toronto, was in Washington, acting as the U.S. representative of the Imperial Munitions Board. The activities of the War Industries and War Trade Boards began to interfere with the free export of goods to Canada, and a steadily increasing number of purchasers sought Mr. Harris' good offices on their behalf. It became evident that an organization had to be formed to deal with these pressing matters, and on February 1st, 1918, the Canadian Government authorized the establishment of the Canadian War Mission. There were five members who served without salary: Mr. Lloyd Harris, Toronto, chairman; Mr. Frank A. Rolph, Toronto; Mr. Arthur H. Scott, Montreal; Mr. Ross H. McMaster, Montreal, and later Mr. J. Allan Ross, Toronto. The staff, which numbered about forty, included a mechanical engineer, and a transportation expert, as well as myself.

At about this date the War Trade Board was instituted at Ottawa, and it is interesting to note that the Canadian Board, in addition to controlling imports and exports, performed likewise, most of the functions of the U.S. War Industries Board. The Canadian War Mission acted as a liaison office in Washington for the Canadian War Trade Board, and conversely called upon the latter for information when this was required.

The work of the Canadian War Mission may be summed up in the expression: the advancement of Canadian interests in the United States. This involved on the one hand the dissemination of information regarding the natural products and the facilities for manufacturing, and on the other hand the proper representation of Canadian requirements in order that our merchants should secure the goods which they required. The Canadian War Mission was in no sense a glorified selling agency, although contracts amounting to over $200,000,000 were placed in Canada by the U.S. War and Navy Departments through its offices. To carry on such work as this it was necessary first of all to educate the officials in Washington to a point where they recognized that Canada had a well-developed industry for the manufacture of munitions of war, and it was with some hesitation that the first contracts were placed in this country by Washington.

You will be gratified to learn that the deliveries on these early contracts were made very promptly, and satisfactorily, by the Canadians, which immediately resulted in the placing of further contracts with our manufacturers. It is not my

*Paper presented but not read at the second convention of Canadian Chemists, Montreal, May 17, 1919.

intention to deal with that phase of the work of the Mission, and I shall merely remark in conclusion that Canadian manufacturers have established a high reputation in the United States for the good quality of their goods and the promptness with which deliveries were made during the war.

The New Washington.

The change in the life of the City of Washington was a subject which hardly ever failed to crop up in conversation with one of the older inhabitants. Before the war, Washington had been a city of government employees, and diplomatic representatives, and rather prided itself upon the fact that it was neither a business nor a manufacturing centre. The establishment of the control of industry by the Government, however, changed all this, and Washington became temporarily the business capital of the United States. Its hotels were crowded with representatives of the industries not only of the United States but of many foreign countries, who found it necessary to obtain the consent of one or other of the various boards to their projects. A number of these men had interests, present or prospective, in Canada, and came to the offices of the Canadian War Mission in search of information or assistance. This afforded an excellent opportunity to present the facilities which Canada could offer, and in a number of cases direct results of great commercial value were the outcome of these interviews.

It would be impossible to go into details regarding this aspect of the work of the Mission, and while I do not propose to discuss it further, I should like to have you carry away the idea that it was one of the most important features.

In July, 1918, the U.S. Treasury issued a regulation prohibiting the sale of any security in the United States which had not received a special sanction. You are all aware of the fact that for a number of years, and in particular since the outbreak of the war, Canada has been accustomed to market large amounts of her municipal and industrial securities across the border, and this market was vitally affected by the regulation just referred to. The matter was discussed at length with the Treasury by the chairman of the Mission, and finally an agreement was arrived at under which the Mission undertook to recommend for sanction, under authority from the Department of Finance, Ottawa, only such securities whose sale would be considered desirable in the best interests of both countries.

In addition to the activities cited below, the Mission was interested in a variety of cases which defy classification. Difficulties arising from the passage of returning Canadian soldiers through the United States; arrangements with Canadian authorities in regard to the release of vessels for urgent needs; negotiations respecting the supply of power at the border points for munitions purposes; and many other matters were dealt with. Through the Transportation Department, shipments were expedited to Canada and where lost were traced up. You will probably remember that the winter of 1917-18 saw an unprecedented congestion of traffic on the railroads, and during this critical time it was essential that Canada should have at the headquarters of the railroad administration of the United States a representative who could press steadily for the shipment of Canadian goods.

I have endeavored in the foregoing to give you some idea as to the general work of the Canadian War Mission, and I propose now to take up those phases of its activities with which I was personally concerned.

As has already been said, the establishment of War Industries and War Trade boards at the end of 1917 produced a sudden interference in the free shipment of goods to Canada, as well as to other countries. It became necessary for any exporter in the United States to secure an export license before his goods could be shipped to Canada, and during the earlier stages of organization at Washington the delays in issuing licenses were most irritating. In many cases licenses were refused in a very arbitrary fashion, without any statement of the reasons for the refusal, so that the Canadian War Mission commenced its work with a large volume of complaints from Canadian merchants, which had to be discussed with officials in Washington who had not been long at their posts.

You are all familiar with the efficacy of personal interviews in matters of dispute, and it soon became evident that the officials who were charged with the administration of the licensing system were, in the main, reasonable men who were open to argument. A considerable amount of the time of both the members and the staff of the Mission was spent in interviewing various officials, with the object of presenting to them particular cases from the Canadian standpoint, in order that some obnoxious regulation might be modified. We established relationships of a very pleasant nature with many of these officials, and in consequence of this we were, I believe, able to secure a more sympathetic consideration of Canadian requirements than would otherwise have been the case.

Before going on to discuss some of the subjects which are of particular interest to you as chemists, I should like to remark that we did not deal directly with matters relating to food and fuel, since the Canada Food Board and the Canadian Fuel Controller dealt with the corresponding boards in Washington directly. Occasionally the Canadian War Mission had to deal with either the food or fuel administration, but not as one of its regular functions.

In order that you may understand the operation of the licensing system, I shall take a specific instance: Smith Brothers in Montreal wish to buy five tons caustic soda from Brown & Company, New York. On receipt of the order, Brown & Co. fill out a form giving the weights, value and destination of the shipment, which form is then forwarded to Smith Brothers, who state thereon the purpose for which the caustic soda is to be used. The form thus filled out is sent by Smith Brothers to the War Trade Board at Ottawa, who give it their formal approval and forward it to the Canadian War Mission. The Canadian War Mission then presents this application to the War Trade Board, and if it be granted, the consignor and consignee are both notified. Should the application be refused, the Canadian War Mission immediately inquires as to why it was not granted and proceeds to secure a reconsideration of the case, presenting any fresh evidence which is considered desirable.

In discussing this work, it will be easier to take up the various articles which caused us difficulty, and consider the various factors which concerned each of these in particular.

Sulphuric Acid.

I know of nothing which will demonstrate more clearly the growth of the chemical industry on this continent during the war than the statistics of the production of sulphuric acid. The United States in 1915 produced annually 4,315,000 tons; in 1918, 8,300,000 tons; calculated as 50°

acid. It was estimated that before the end of 1919 the production would have reached 10,000,000 tons.

The production in Canada in 1913 was 69,000 tons; in 1918, 216 000 tons; calculated as 50° acid. As you will see from these figures, Canada has become the producer of sulphuric acid on a considerable scale, and for this reason it was not necessary to import any considerable quantities. Occasionally, however, some oleum was required for fortifying in the explosive factories, and we did not experience any difficulty in securing export licenses when the shipment was to be used for direct war purposes. Receiving as we did a sufficient supply of sodium nitrate, there was no necessity to import nitric acid, and only small quantities of this were required for laboratory purposes.

Caustic Soda.

The procurement of a sufficient quantity of caustic soda to meet Canadian requirements was one of the most difficult problems which we had to face. The supply in the United States was always less than the demand, and a system of rationing foreign countries was adopted. The reasons for the shortage were several. In the first place, the output of the country was not increased very rapidly, owing to some hesitation regarding post-war conditions. Again, large quantities were required in the manufacture of picric acid, and for various other war activities. In the third place, the European countries were unable to export the amounts which they had formerly shipped to all parts of the world, which created an enormous export demand for caustic soda in the United States.

The War Trade Board devised a scheme under which an export license would only be granted to a U.S. exporter for a shipment of caustic soda to Canada, provided the exporter had shipped to Canada during the previous year. This regulation was not made public at first, and caused us a great deal of trouble and uncertainty; numbers of applications for export licenses were refused, and apparently, for no good reason. After months of negotiations and struggle, an improved scheme was arranged, and just prior to the armistice we had finally succeeded in impressing our point of view upon the War Trade Board, which would have removed the outstanding difficulties. One hears so many predictions regarding what would have happened if the war had continued,that I shall spare another one on the subject of the supply of caustic soda.

Sodium and Potassium Nitrates.

By the arrangement of the International Nitrate Committee, 1,800,000 tons of crude sodium nitrate from Chile were allocated to the United States for 1918 with the understanding that Canada's needs should be supplied from this amount. The Canadian explosive factories and packing houses received their requirements without particular difficulty, but the fertilizer industry fared badly. The United States Department of Agriculture had prepared a programme calling for the distribution of 120,000 tons to the farmer, but the submarine activities compelled the abandonment of this policy, and only a small quantity of Chile nitre was actually released for agricultural purposes. We could not discover whether the allocation of the 3,500 tons required for fertilizers had ever been made to Canada by the International Committee, but the matter had in reality very little significance since the available supply was urgently required for war purposes. The necessity that a manufacturing country like Canada should be properly represented at conferences in which her interests are discussed is, to my mind, admirably illustrated by this incident, for had this representation been in effect, the question of a supply of Chile nitre would have resolved itself into a transportation problem.

Toluol.

You are all familiar with the efforts which were put forth by the warring nations in Europe to secure the maximum amounts of toluol, and are, no doubt, aware that the United States took similar action. The price was fixed at $1.50 per gallon and only small quantities were released for chemical use. The U.S. Ordnance Department proceeded to arrange with gas and coke oven plants for the installation of gas washers and a considerable number of these were erected during 1918; negotiations were carried on with the Canadian gas companies regarding the recovery of toluol but no arrangements had been effected at the signing of the armistice.

The export of chemicals manufactured wholly or in part from toluol was rigorously controlled, and in the first few months of the existence of the War Trade Board, the regulations caused us much trouble. Applications for export licenses for saccharine, benzoic acid and other toluol derivatives were uniformly refused, and it was only after much argument and repeated applications that small quantities were permitted to come to Canada.

It might be added at this point that phenol was being conserved for picric acid, and many of the dyestuffs were restricted on that account.

Mercury.

The large quantities of fulminate required caused a sharp rise in the price of this metal during 1915 and 1916; by 1917 the supply in the United States was not large and in 1918 the export was prohibited. The Canadian Electro Products Company, of Shawinigan, used considerable amounts of mercury for the manufacture of acetic acid from acetylene, and enlisted the Canadian War Mission in an effort to secure the necessary quantity. Even with so important a product, there was some difficulty in obtaining the necessary licenses, and attempts to provide mercury for other purposes of less essential nature were failures. Pharmaceutical preparations were more generously treated, but I have often wondered how some individuals who represented their needs as very urgent, managed to keep business going without the usual supply of mercury.

Potash.

For the first part of 1918, export licenses for potash in any form were consistently refused by the War Trade Board, and Canadian trade was suffering greatly. As was apparent later, the officials responsible for this action were unduly alarmed over the shortage in the supply and by a curious turn of the wheel, over 100,000 tons of potash salts are now reported in stock in warehouses in the south, without purchasers in sight. The export embargo bore very heavily on the pharmaceutical products and for a long time our arguments and protests fell apparently on deaf ears. By the middle of the year, however, a change came over the situation and the restrictions were modified, but it was not until autumn that any potash salts could be obtained for the fertilizer industry. It would be very interesting to make a collection of the cases in which potassium salts have been replaced by the corresponding sodium salt during the war, noting particularly the changes in process or product which resulted from this substitution. It is likely that with the experience of the last four years as a foundation, manufacturers will hesitate to return to the more costly potassium salt if the sodium compound can be made to meet the requirements.

In view of the attitude of the U.S. War Trade Board in

the beginning of 1918, investigations were made as to the possibility of obtaining potash salts from domestic sources. A considerable quantity of wood ashes was available in various parts of Canada, and these could have been worked at a small capital outlay. When the industry was so well established in Michigan and Wisconsin, it is rather surprising that no one, in Ontario at least, took advantage of the active demand for potash salts to recover these from wood ashes. The waste liquors from wood scouring in a Canadian mill were examined, and had the necessity arisen would have yielded a considerable quantity of potash at a not unreasonable cost. The rapid development of the potash industry at the Nebraskan and Californian lakes, however, gave the United States an exportable surplus, and the inducement to domestic production disappeared.

Acetates.

As long as the United States preserved her neutrality, the Allies were able to secure large supplies of the chemicals derived from wood distillation through ordinary commercial channels. Indeed, a number of months had elapsed since the entry of the United States into the war before her Signal Corps realized the necessity of conserving the supply of acetic acid if there were to be an ample supply of cellulose acetate aeroplane varnish. This led to the institution of a rationing system for all the products of wood distillation, and the export of these was prohibited. In the United States the War Industries Board restricted the use of acetates in dyeing and print works to the actual amounts required for Government contracts; on commercial work only 25 per cent. of the quantities usually employed were permissible.

In Canada we were faced with the situation that although we produced large quantities of acetic acid, we lacked manufacturers who made acetates either regularly or intermittently. The uncertainty of the future and the comparatively small volume of business in this country were unfavorable factors affecting the installation of new plant, and it was therefore necessary that we should look to the United States for such supplies as were necessary. The negotiations as Washington in respect to the supply of wood chemicals were complex and troublesome, but supplies were obtained which were sufficient for the most pressing needs of Canada.

Phosphorus.

Although phosphorus is made in Canada, it is not here converted into the red or amorphous modification. The facts that the Canadian market is small and that the operation could be conducted more cheaply in a plant with large output are the obvious reasons for the non-development of this industry here; reasons, too, which will steadily decrease in significance as the population and industries of the country increase. Our phosphorus was used very largely for smoke screens at sea during the war, and we imported from the United States the red phosphorus and sesquisulphide required by the match factories. The whole situation had to be taken up at some length with both the War Industries and War Trade Boards, before the necessary export licenses were granted, and it is not altogether surprising that the officials had difficulty in seeing just why Canada should get phosphorus while it was denied to others.

Chlorine.

The programme of the U.S. Chemical Warfare Service called for such large quantities of chlorine that about the middle of 1918 an embargo on its export was suddenly imposed. The number of protests which reached the Canadian War Mission was a surprise, for the practice of water sterilization by liquid chlorine has spread rapidly in smaller municipalities in this country. Unless one were immediately in touch with this business, there would be an impression that a few cylinders would represent the annual needs, whereas the number runs into hundreds and any interference with the supply constitutes a serious menace to public health. This was recognized by the U.S. officials and no Canadian municipality suffered, as far as I am aware.

Ammonia.

It was rather curious that the regulations regarding ammonia and its salts originated in the Food Administration, but this was due to the extensive use of the gas in refrigeration plants. The control of food was so intimately connected with the problems of cold storage that the reasonableness of this arrangement was apparent, although a fresh complication was introduced into the already intricate system of issuing export licenses. Prior to 1918, Canada produced liquor ammonia and ammonium sulphate only from the gas and coke-oven liquors, which left the chloride, bromide, carbonate and nitrate to be supplied by import. At the same time, we had for export over 10,000 tons of ammonium sulphate, most of which went to the sugar plantations of the West Indies. Here again, we felt the lack of a small manufacturing industry, which would have served as a nucleus for greater production, if necessary. Delays of months in issuing licenses for the export of sal ammoniac were frequent and the response to our protests was merely: "You have plenty of ammonia in Canada, make these salts yourselves." I am very pleased to be able to state that one Canadian firm did commence to manufacture sal ammoniac, which greatly relieved the situation. The Food Administration recognizing the value of ammonium carbonate in baking was fairly generous in granting export licenses for this substance.

It will be remembered that the War Trade Board was established to preserve and foster as far as possible the export trade of the United States; at the same time, it could issue export licenses only if the domestic supplies were sufficient in the judgment of the War Industries Board or the Food Administration. The consequence was that the policy of the War Trade Board changed continually, as it was affected by varying influences, and no settled line was ever pursued for very long. This in turn prevented the Canadian War Mission from recommending to Canadian manufacturers the establishment of new factories on the supposition that the supplies from the United States would be cut off, and the uncertainty of the future was the real reason for the non-development of some Canadian chemical industries during the war. We, as chemists, have been accused in the press of being slothful and unprogressive because of some temporary shortage in imported goods, but those who complained most bitterly would not themselves have risked a dollar on so uncertain an undertaking. The manufacture of the ammonium salts is an excellent illustration of an industry which could readily be carried on in Canada if suitable protection could be secured for a small business.

Arsenic.

Although there was not much difficulty in securing export licenses for compounds of arsenic, there were some interesting developments in this connection. As in the case of ammonia and its salts, the Food Administration took charge of arsenic in which they were deeply interested, as a source of insecticides. We were permitted to obtain

certain supplies of the latter early in 1918, and the building of two plants for the manufacture of insecticides in Canada relieved us of all necessity for further endeavors. A new phase, however, opened up during the early autumn, when large demands were made by the war offices of Great Britain and the United States for supplies of arsenic trioxide for poison gases. The programme was so ambitious that only by curtailing the output of insecticides could the necessary amounts of this substance be obtained, although new plants were rapidly coming into production. We were busy with the officials of the Food Administration, trying to plan a distribution of the joint production of Canada and the United States, so that there should be as little dislocation as could be compassed, when the good news arrived on November 8th. Canada, with her possible production of 1,800 tons of arsenic trioxide per annum, would have been able to make a very valuable contribution to the Mother Country, and thus render the latter less dependent on the United States.

As you will see from the illustrations cited above, it was frequently necessary to explain to the War Trade Board that the articles under application were not manufactured in Canada. This naturally led to conjecture as to why these articles were not made in Canada, which in turn provoked an inquiry into the causes of this condition. While I cannot profess to do more than sketch the outlines of a complicated picture, you may be interested in hearing some of the conclusions which forced themselves upon me.

Possibilities for Canadian Chemical Industries.

As a preliminary, it must be recognized that what may be truly said in one part of the Dominion may be false in another, and the various sections of the country are bound to differ in their industrial development in proportion to the bounty of their natural resources.

Ontario and Quebec labor under the disadvantage of an almost complete lack of coal and oil. Since fuel is almost always an important item in chemical manufacturing, these two provinces start in the race with a decided handicap. On the other hand, the Maritime Provinces and British Columbia, though amply provided with fuel, have only small local markets and must ship to considerable distances. The prairie provinces, having only a small industrial development, offer a limited market for chemicals which is, no doubt, the chief reason for the non-establishment of this industry in the West.

In the United States, on the other hand, we find a number of districts occupied by large groups of industries and provided with convenient supplies of fuel and other natural resources. We may cite, for example, the great manufacturing zone of the Northern Atlantic States, the district at the head of Lake Michigan, Pittsburg, West Virginia and Northern Alabama. From the standpoint of natural resources we may therefore conclude that there is no district in Canada, except the Atlantic or Pacific Coasts, which is able to offer such advantages to the manufacturer as those portions of the United States referred to above.

The second obstacle to the establishment of a chemical industry in Canada is the smallness of the local market. This would be unimportant if the cost of production is so low as to permit the sale of the article produced in the world market, but this has only rarely been the case. The manufacturer has, therefore, to content himself with a small output with its accompanying disadvantages. You are familiar with the fact that an increase in production is almost invariably accompanied by a lowering in the overhead costs and frequently also in the labor cost, while the advantage in purchasing raw materials on a large scale is well known. It is obvious, therefore, that the foreign manufacturer, who has usually cheap raw materials or a large domestic market, will be able to export his goods to Canada at prices below those at which they could there be made. As the population and industrial development of Canada grow, this condition will gradually tend to diminish in importance, and we may, I believe, look forward with confidence to the establishment of chemical factories in measure with the progress of the country. It is plain that this conclusion must be modified if the tariff is to extend any special favors to chemical industries, as is now being proposed in the United States.

The third factor in the establishment of a chemical industry is the chemist himself. With the record of the war years to point to, it is unnecessary for me to say anything on this point. We must reserve our words for the public who know so little of our activities.

Having reached the conclusion that we are not likely to see any sudden boom in the ordinary lines of chemical manufacturing, we may proceed to speculate as to what the future holds in store. Quite certainly our electro-chemical industries will continue to flourish and grow while new discoveries will lead to further establishments. Our water powers, of which many are in comparative proximity to the industrial districts, give assurance that we shall hold an important rank in this branch of chemical industry.

There is also another division which can be developed in this country—those processes which operate under patent protection or which result from the special knowledge and skill of the operators. The chief factor here is the personnel of the organization who must plainly be highly trained as well as original, and it is interesting to note that in these cases the product is not usually sold for a few cents per pound. You will see, of course, that I have in mind the possibilities of research, and we have heard so much on this subject of late that I shall not make any further comment. There can be no doubt, however, that, being somewhat handicapped in Central Canada in regard to natural resources, we must endeavor to make up for the deficiency by a steady pursuit of the various lines of investigation which present themselves.

Before closing, I should like to add that what I have said applies only to the manufacture of chemicals. The numerous industries in which chemistry plays a more or less important part will be influenced in establishing factories in Canada partly by the market and partly by the abundance of the supply of their raw materials, the manufacture of pulp and paper being an excellent example.

There is no doubt that the chemist will be called on more and more to give aid to the industries, and we shall find in the growing recognition of the value of his services the surest foundation for the advancement of our profession.

TO HOLD OPTICAL TRADE.

Great Britain intends to hold, or at least attempt to hold, the scientific optical trade which the war brought back to England. Such was the announcement made by Sir Alfred Keough, rector of the Imperial College of Science and Technology at South Kensington, London, England. It is recognized that this can only be brought about through research and through the training of high-grade men. Already the Imperial College has equipped laboratories and perfected plans whereby they are confident that they can compete successfully with anything in the optical line in either America or Germany.

Final Report of Chemists' Organization Committee

To the Chemists of Canada in Convention Assembled, as Amended by the Majority Vote at the Convention

ON May 22nd, 1918, the Chemists' Convention, held in Ottawa, passed the following resolution: "Resolved, that whereas this meeting is of the opinion that it is desirable to form an Association of Chemists, the Chairman do and is hereby authorized to appoint a Committee to report in the matter to a future meeting." Carried. As a result of this resolution the "Chemist Organization Committee" came into being.

It is felt that this report should not fail to include a tribute to the activities of the late Dr. Girdwood and Doctors A. McGill and R. F. Ruttan, who assisted him in what was probably the first attempt to initiate an organization of Canadian Chemists. The correspondence which these gentlemen had, and which was kindly passed on to the Secretary of the C.O.C., was of no small assistance in the framing of the Committee's report.

Your Committee has held seven meetings, two in Ottawa and five in Montreal. At each of these meetings a majority of the committee were present. After each meeting the members unable to attend were notified in detail of all that occurred, and their comments were submitted to those present at the meeting, with the result that unanimous decision was finally arrived at on the various points as set forth in the Committee's preliminary report, which was published in the April issue of The Canadian Chemical Journal and mailed to the chemists of Canada individually a few days later. The basis of the mailing list was that of the last convention, together with as many additions as could be obtained. The number of copies of the report mailed was 700. About fifteen letters were returned as unknown, and the mailing list has been corrected accordingly. Thirty-one letters have been received containing costructive criticism of the preliminary report. A list of these writers is on hand, as also a list of towns represented by them, amounting to twenty-two, ranging from Nanaimo, B.C., to Sackville, N.B. A ready response was made to the Committee's request for funds to cover printing, stationery and mailing expenses. Up to date the list contains forty-three subscribers with a total of $180.75. Those subscriptions received up to the beginning of May have been published in The Canadian Chemical Journals for April and May. Each subscriber has received a personal acknowledgment in addition. The following is a summarized statement to date of receipts and disbursements: $180.75 has been received as a result of forty-three subscriptions, which, together with twenty cents bank interest, makes a total of $180.95. Services of a paid stenographer, to a very limited extent, together with the necessary stationery, stamps and telegrams, amount to $156.50, leaving a balance in hand of $24.45, out of which has to come stenographic services, etc., as required from the date of this report to the date of the convention. There are no outstanding liabilities other than this, though special expenses may very reasonably occur during convention.

Before submitting the further details of the final report the committee also desires to emphasize most strongly and clearly that the proposed new Institute of Chemistry is NOT intended in any way to replace the Society of Chemical Industry. This should be the more apparent from the fact that practically all the members of the Committee are at the same time actively engaged in official positions in the Society of Chemical Industry. The need of organization of the chemists of Canada is a professional one. There will still remain a very great need for the bringing together of the chemists and those interested in chemical industry.

The Committee, after careful consideration of the suggestions received, is of the opinion that:

(1) The organization of Canadian chemists is best undertaken by an entirely new and separate organization rather than by endeavoring to carry out such organization under the auspices of any existing society.

(2) The name "Canadian Institute of Chemistry" is the most suitable name for such an organization.

(3) The nucleus of the proposed association be a body of Original Members.

(4) The membership consist of two classes, Fellows and Associates of either sex, the former having the right to use the letters F.C.I.C., and the latter having the right to use the letters A.C.I.C.

(5) The following be the requirements for Fellows:

(a) One who shall be of the age of twenty-five or over, being a graduate of a recognized University, having a four-year course in chemistry or science, and who can satisfy the Council that Chemistry, pure or applied, has been his major subject, and who has been actively engaged in the pursuit of chemistry in a responsible capacity for two additional years.

(b) One who shall be of the age of twenty-five or over, being a graduate of a recognized University giving only a three-year course in chemistry or science, who can satisfy the Council that chemistry, pure or applied, has been his major subject, and who has taken another year's training in chemistry at a University, and has had in addition two years' experience in chemistry at a laboratory approved by the Council or under the direction of a Fellow of the Institute. If the additional year at a University is not taken, then three years' training in a responsible capacity in a laboratory approved by the Council.

(c) Those who do not qualify under (a) or (b), being of the age of twenty-five or over, shall have held a position of responsibility in pure or applied chemistry for not less than five years and shall be examined by a Board appointed by the Council. The candidates shall be examined on the theory and practice of chemistry, with special reference to the branch of chemistry in which they have been engaged. This examination may be waived at the discretion of the Council if the candidate was engaged in Chemistry at the date of the inauguration of the association and has held a position of professional responsibility for not less than eight years.

The following be the requirements for Associates:

(1) Persons being under twenty-five years of age who would otherwise be eligible for membership as Fellows under provisions (a), (b) and (c), the requirements under (a) and (b) regarding the practice of chemistry in a responsible capacity for two years being waived.

(2) An Associate upon reaching the age of twenty-five

may become a Fellow, providing he is recommended by three Fellows and has been engaged for at least two years in the practice of chemistry, pure or applied.

(3) All applications for either Fellowship or Associateship must be accompanied by references from at least three Fellows of the Institute.

(4) Each candidate shall submit evidence to the Board to satisfy the said Board that the candidate has a good general education.

(5) The officers of the organization for one year from date of election shall be:

1. President.
2. Three Vice-presidents.
3. Secretary-Treasurer.
4. Executive Board consisting of President, Vice-Presidents, Secretary-Treasurer, and ten other members, called the Council.
5. Examining Board consisting of, say, fourteen members.

(6) The Entrance Fee for Fellows be ....., in addition to an annual fee of ....., and that the fees for Associates be one-half the above, all fees being payable in advance.

(7) The objects of the Association be:

("A") To raise the profession of chemistry to its proper position amongst the other learned professions, so that it may attract a larger proportion of the best intellects and thereby secure a supply of trained chemists adequate to the growing industrial needs of the country.

("B") To form an organization immediately available for consultation by the Government.

("C") To protect the public by gathering together a body of men who may be consulted with confidence.

("D") To look after the professional well-being of the chemist by:

1. Having a registration bureau for chemists.
2. Having social centres for chemists, and chemists only.
3. Maintaining an employment bureau for chemists.
4. Having centres for the interchange of scientific experience by both papers and lectures.
5. Maintaining a clearing house of available chemical knowledge, including a library and suitable register that would enable the central bureau to put one chemist in touch with that other chemist who might be able to assist him in his particular problems (leaving it to the parties interested to arrange details as to recompense or otherwise).

("E") To secure such Government recognition as may from time to time be deemed advisable.

("F") To maintain a professional association for professional men.

The Committee suggests the following procedure as the best way of getting a real start made in organization:

(It has been suggested that we are not yet ready to launch an association. It is the opinion of this Committee that if we do not make a start now we are never likely to be in a better position.)

1. The adoption by the convention of the final report, as IT MAY BE AMENDED BY A MAJORITY VOTE at this convention.

2. The election by this convention of Original Members belonging to the following classes:

(a) Professors of recognized Universities teaching chemistry, either pure or applied.

(b) Heads of Government laboratories doing chemical work or industrial research connected with chemistry.

(c) The chief chemists of representative industries of Canada.

Note.—A suggestive list of Original Members has been prepared by the Committee, having regard to equitable representation of three classes of Chemists, as outlined above.

3. The following twenty-eight gentlemen form the nucleus of Original Members:

Nova Scotia—Messrs. MacKay and Forward.
New Brunswick—Messrs. Blake and H. E. Bigelow.
Quebec—Messrs. Charron and Baril.
Montreal—Messrs. Roast, Grageroff, Bates and Ruttan.
Ottawa—Messrs. Shutt, Cook, McGill and Race.
Kingston—Messrs. W. L. Goodwin and L. F. Goodwin.
Toronto—Messrs. Bain, Burton, Ardagh and Lash Miller.
Manitoba—Messrs. Parker and Birchard.
Saskatchewan—Messrs. McLaurin and Thorvaldson.
Alberta—Messrs. Lehmann and Kelso.
British Columbia—Messrs. McIntosh and Dawson.

4. The election of a Committee to organize the necessary machinery for the election of the Council BY THE ORIGINAL MEMBERS.

5. The gentlemen of the Council shall be elected for a period of one year from date of election on the understanding that they are to conduct the affairs of the Institute along the lines of the report adopted, and proceed to obtain a charter. If this is successfully accomplished, to then proceed to carry on the affairs of the Institute and to accept applications for membership and to call a general meeting of members at a date and place to correspond to the next convention.

The whole of this report is now revised by your committee on the basis of the amendments made to the original report by the majority vote of the convention, and, as such, is respectfully submitted.

MATTHEW PARKER,
Chairman, Winnipeg.
HAROLD J. ROAST,
Secretary-Treasurer, Canadian Institute of Chemistry, 314 Beaver Hall Hill, Montreal, P.Q.

May 21, 1919.

RAILWAY MANAGER AND PROFESSOR AGREE.

Mr. C. Price Green, President of the Industrial and Resources Department of the Canadian National Railway, agrees with the policy urged by Professor R. D. MacLaurin, of the University of Saskatchewan, Saskatoon, in regard to the development of agricultural and mineral resources of the Canadian West. During a recent visit to Saskatoon, Mr. Green declared that the best method of attracting capital to develop Canada's resources would be to have proper surveys made of the country's resources.

"The amount of money spent by Canada on investigations and exploitary work," said Mr. Green, "has been very small in proportion to her vast areas, and on account of

divided jurisdiction, another cause is, even the information that has been gleaned is more or less scattered in numberless publications issued from time to time by the Dominion and Provincial Governments, and for this reason largely rusting from disuse.

"Geological survey and development work are very badly needed, so that people may be able to obtain some definite idea of our mineral areas. A number of returned men could be employed on exploitary parties and assisting in this work, and perhaps there is no way in which the country could derive more benefit from their services.

"The necessity of conservtng and developing the resources within the Empire has been brought home by the war. As a result, I have information that there is a large amount of British capital that can be directed to Canada, if proper steps are taken to that end. We, however, must do our part by showing that we have sufficient competence in the country to carry on investigation and research work and let the world at large know what we have, not only in agricultural resources, but our minerals, forest products and fisheries as well. The man on the street in London, as a matter of fact, knows more about Rhodesia and South America as a field for investment than he does about Canada, mainly because his attention has been directed in those channels of investment.

"The next stage should be scientific investigation to prove what we can do with many of these resources. Whether it is done by the provinces themselves or the Dominion, the necessity for this work is imperative. There are numerous fields for our economic minerals that have not been developed, and these should receive immediate attention and industrial activity will quickly follow. Instead of importing our raw materials and manufacturing on lines in which we have no economic advantage, meantime shipping our raw products out of the country in bulk; we should manufacture these natural products ourselves for the foreign, as well as the domestic, markets. If we manufacture our own raw materials, using the natural advantages we possess, more particularly our magnificent water powers, choosing those lines of activity in which we have an economic advantage, our commercial development will follow upon a parallel line with Canada's most important industry, agriculture."

JAMES F. KERR, V.C.

To win the Victoria Cross, the highest military honor in the British Empire, at the age of 23 years, has been the achievement of James Fraser Kerr, captain in the Third Battalion, Queen's Own Rifles, of Toronto. Into his 24 years of life he has crowded experiences of which many a grey-haired veteran of the army would be glad to own even a small part. He was born at Deseronto, Ontario, in 1895, the son of Mr. and Mrs. J. J. Kerr, who now reside at Toronto. It was while living at Galt, Ontario, and attending the Collegiate there that he first got interested in chemistry and made it his "pet" subject. He matriculated from there when he was seventeen. Always fond of hunting and other outdoor sports, he yet found time to devote many a spare hour to do some work in the collegiate laboratory just from his desire to do so. Following matriculation, he spent some time in the laboratory of the Dominion Sugar Company at Bridgeport, Ontario, and for a few months was in the laboratory of the Dunlop Rubber Company, Toronto, and later in the laboratory of the American Cyanamid Company at Niagara Falls, N.Y. He intended entering the University of Toronto in the autumn of 1914, in Chemistry.

Then came the war. He was one of the first to enlist, signing up as a private with the First Contingent, August 10, 1914. After training at Salisbury Plain, England, he went to France in February, 1915, with the rank of Sergeant. On July 30, 1916, while going back for reinforcements through a heavy barrage he was wounded, carrying at the moment a wounded comrade who had also been hit, and for this deed he was awarded the Military Medal. As a result of his wounds he was laid up for five months in hospital in England. On recovering he trained in England for his commission and returned to Flanders as A.D.C. to an officers, afterwards rejoining his old battalion, the 3rd. On August 8, 1918, he won the Military Cross when he organized and led with great valor an attack that put a German machine gun out of business that was causing no end of trouble to our men. Thirty Germans fell before his attack that day, and many were captured, but not before "Bobbie" fell severely wounded in arm and leg. Despite medical persuasion and even orders to remain out of further fighting he tricked his examiners at inspection by showing his leg wound and not his severe arm wound, and got back to his unit in the front lines. On September 2nd he won a bar to the Military Cross and was promoted to a captaincy on September 27, 1918, after a series of brilliant achievements during the Bourlon Wood engagement on the Canal du Nord, he rushed forward, capturing four machine guns and thirty-one prisoners, absolutely single-handed, saving great loss of life to his men. This earned him the Victoria Cross. His work was an inspiring example to everyone that day. "It was just luck, that's all," he declared to the writer, who found our young V.C. man much more willing to talk of chemistry and his interest in it than of his achievements at the front. He arrived home during the first week in June, and is now deciding whether to continue his chemistry studies or enter business with his father. Should he choose the former the chemists of Canada will be forever honored by his entrance among them, and if not, his early desire for chemical knowledge and work make him almost one of "our own" and one to be always proud of.

James Fraser Kerr, V.C.

INDUSTRIAL SECTION

Alberta.

Edmonton.—Prof. J. C. Gwillim, of Queen's University Science Department, has been asked to make a survey of the foothill country in Alberta to determine whether it contains iron ore in commercial quantities.

W. C. Caton, G. H. Way and R. Blackerby have installed a complete new equipment for electro-plating in the city at 10154 102nd Street. W. C. Caton, B.Sc., formerly with the city engineering department of the city, and now with the Bulletin Co., Ltd., has financed this new enterprise.

British Columbia.

Clayoquot.—The Clayoquot Cold Storage and Canning Co. is building a plant at Clayoquot, which is to include cold storage and canning equipment, involving an expenditure of $150,000.

Falkland.—The B. C. Gypsum Co. is planning to erect a plaster mill here.

Nelson.—The McDonald Jam Co. are erecting a two-storey cement and granite jam and candy factory, 100 x 120 feet in size and with 22,000 square feet floor space. The plant will be equipped with up-to-date machinery, and it is expected that a million pounds of fruit will be handled this season.

New Westminster.—The British Columbia Manufacturing Co. has obtained a permit to erect a new export plant at Queensborough.

Vancouver.—The Hyatt Steel Products Company has reopened the rolling mill at Port Moody and has made several improvements to the building and plant acquired by them from the Tudhope Electric Metals Co. at False Creek. The company is also increasing and improving its steel plant on Industrial Island.

The Dominion Canners' Association is absorbing a number of the British Columbia fruit canneries, these including the Vantoria Canning Company, the Kelowna Packing Company and Food Products, Limited. This amalgamation now includes over fifty per cent. of the fruit and vegetable canning enterprises of the province, and the new company, which has its own charter, will be operated independently of the eastern plants of the company.

The Morrison Steel & Iron Works has taken out a permit for a new factory on Industrial Island. The building, which is to be of mill construction and sheet iron, is to cost $28,500.

Vernon.—The Vernon branch of the Graham Evaporating Co., Belleville, Ont., which closed down early in April, paid during the past season over $127,000 for potatoes to the farmers of the Okanagan district. During the season $70,000 was paid in wages by the company, which shipped nearly two million pounds of desiccated potatoes, which were purchased by the American Government for its overseas army.

New Brunswick.

St. John.—It is expected that before long an adjustment of the shell contracts which the McAvity Company were engaged in at their Marsh Road plant will be reached, so that the firm will be free to develop the plans which they have in view for these immense works. In the meantime the new steel foundry in the rear of the munition factory is being completed and made ready for work.

The Swift Canadian Co., Ltd., and the Armour Company have both acquired properties at St. John and propose establishing large meat storage depots at an early date. In addition to these operations Gunns, Ltd., under the management of Mr. J. A. Kennedy, have for a number of years carried on a growing business at this port. Recently the Harris Abattoir Company established here.

The Canadian Cottons, Ltd., who have a large plant at Milltown, N.B., are planning a diversion of the St. Croix River at that point and the establishment of a large power station. The company's plans will involve an expenditure of over half a million dollars. The Canadian Cottons, Ltd., have two large mills at St. John, the York and Cornwall.

Nova Scotia.

Glace Bay.—The Dominion Coal Co. is erecting a turbo compressor at its Springhill Mine in Cumberland County. The plant was ordered in the early part of 1915, but, owing to war orders, it was not delivered until the end of 1918. The compressor is turbine-driven and is of nine thousand cubic feet capacity. It is a mixed pressure type, but will be largely operated by exhaust steam. Condensers and cooling arrangements form a part of the installation. The air will be used for pumping, haulage and other classes of work in the mine, and in particular will replace steam at large pumps that have been installed for many years.

Ontario.

Arnprior.—Kenwood Mills, Ltd., have awarded a contract for the construction of a large fire-proof wool room.

Chatham.—A delegation from the Chatham Waterworks Commission recently inspected the new rapid sand water-filtration plant at Amherstburg, Ont., changes in the Chatham system being contemplated. The Amherstburg plant was constructed by Brunner Mond Co., and was put in operation in March of this year.

Cobalt.—The sampling plant of Campbell & Devell has been taken over by the Government and is henceforth to be known as the Timiskaming Laboratories.

Elmira.—A new warehouse and addition to factory buildings for the Great West Felt Co., Limited, will be erected shortly.

Goderich.—Announcement has been made of the formation of the Huron Steel Corporation with a capital of $15,000,000, to engage in the manufacture of automobiles, trucks and parts. The building of a Hydro power line to furnish 25,000 h.p. for use at the plant and the enlarging and deepening of the harbor are among the improvements aimed at in connection with the establishment of the industry.

Guelph.—Contract has been let by the Northern Rubber Co. for the erection of a building costing $100,000.

A building permit has been issued to the Carpet and Worsted Spinning Mills for erection of a new mill and dye house at a cost of $35,000.

Hensall.—The Jackson Manufacturing Co., of Clinton, have decided to erect a plant here.

Hamilton.—A new varnish-making industry has been secured for Hamilton, and building operations have commenced on the two acres formerly occupied by the National Abrasive Co. W. J. Wix, of Toronto, is President.

Zimmerman-Reliance, Limited, have completed a third storey, 450 feet long by 63 feet wide, over the whole of their plant here. The extension has been erected to take care of the hosiery department.

Mercury Mills, Limited, are extending their main mill about 125 feet, using the same type of construction, reinforced concrete, as in the present building.

Extensions, costing about $35,000, are being made by Wagstaffe, Limited. These include putting part of the second storey on and adding new boiler and stoker. The latter are for the candied peel department, a new industry for this country, since Canada has always been supplied previous to the war by English manufacturers.

Plans for the erection of a new modern two-storey factory for the National Paper Goods Company are being prepared by the architect, F. W. Warren. The site will be next to the site recently secured by the Hoover Suction Sweeper Company.

Harrow.—Quality Canners, Limited, will erect a factory here at a cost of about $12,000.

Hastings.—The Hastings Tannery, owned by the Breithaupt Leather Co., of Kitchener, which was destroyed by fire in October, 1917, will probably be reopened in July. It has been rebuilt at an expense of $200,000. The new building is in the same site as that of the former plant. The main building, a two and a half storey erection, built of concrete block, covers 205 by 130 feet and is valued at $50,000. On the lower floor 120 to 150 vats are being installed, and when completed will have a capacity for tanning four hundred sides a day. The product of the factory, oak sole leather, will be distributed from Kitchener. In the upper part of the building, in a room 150 by 130 feet, the drying by artificial means will be carried on. In all, the buildings will number six, built of concrete.

Oshawa.—The Ontario Steel Products, Co., Limited, will erect a factory, 80 x 315 feet, in Oshawa, Ont.

Peterboro'.—The City Council last month passed a by-law to authorize entering into an agreement with the Stickney Motors, Limited, St. Paul, Minn., under which the company agrees to take over the old cordage works recently vacated by the Renfrew Manufacturing Co., and manufacture farm tractors, motor trucks and gasoline engines, employing for nine months each year for ten years a minimum of fifty employees. Tax exemption will be granted by the city.

Preston.—The Preston Arena Company, Limited, plan to build an artificial ice plant here at a cost of $30,000, with opening day on October 15th next. The plant will be for skating rink hockey purposes.

Port Hope.—A plant to manufacture in Canada the Hauck oil burners has been established by the Canadian Hauck Burner Co., Limited.

Port Colborne.—Work on the Canada Cement Company's potash plant is progressing satisfactorily.

St. Mary's.—The St. Mary's Flax Co. contemplate purchasing a site and erecting a factory.

Sarnia.—Ferguson & McCutchen are converting the northern section of the old woollen mills building, Front Street, into a cold-storage plant.

The Romeo Foundry Co., Port Huron, will erect a $50,000 foundry here.

Stratford.—Contracts have been let for the construction of an addition to the plant of the R. M. Ballantyne Co., the work to be completed in September. The cost will be about $30,000.

Toronto.—Puddy Bros., Limited, will make an addition to their abattoir.

A new storey is being added to the Glidden Varnish Company's largest building, which will double its present grinding capacity.

Plans are in progress for an addition to the factory of William Wrigley, jun., Carlaw Avenue.

Hiram Walker & Sons, metal products, of Walkerville, have opened a sales store on King Street West, Toronto, where the different products of their celebrated metal castings will be on exhibition and for sale.

The Cowan Co., Limited, 72 Sterling Road, will make an addition to their factory.

Walkerton.—The Canadian Spool & Ribbon Co. will erect an addition to their plant at a cost of $10,000. Ratepayers voted favorably on a by-law extending assistance.

Weston.—The K. & S. Canadian Tire & Rubber Co., Limited, are planning an extension to their factory, to be used for molded rubber work.

Windsor.—Work on the new plant of L. W. Lawrence & Co., to be constructed on one of the city's factory sites, will begin within the next few weeks.

Quebec.

Cap a la Madeleine.—The St. Maurice Paper Co. will build a machine shop and model shop here at a cost of $25,000.

Chicoutimi.—An addition is to be made to the mills of the Chicoutimi Pulp & Paper Co. at a cost of $375,000.

Grand' Mere.—A $30,000 finishing room is being erected by the Laurentide Co.

Lachine.—Lague Heating System, Limited, 56 St. Patrick Street, plans to make an extension to its factory.

Montreal.—A contract has been let for the erection of a $45,000 factory for Thos. Davidson Manufacturing Co., Delisle Street.

An addition is being made to the factory of the Acme Glove Works, Limited, 181 Vitre Street East.

Plans are being prepared, it is said, for a new plant for the Montreal Portland Cement Co.

The erection of a $150,000 abattoir is planned by the Montreal Abattoirs, Limited.

Plans are in progress for a $25,000 extension to the plant of Dupont & Freres, Aird Avenue, Maisonneuve.

Quebec.—Duchaine & Pedkins, Crown Street, are making a $35,000 addition to their factory.

St. Boniface.—J. W. Boisvert has purchased a site for the erection of a $10,000 factory.

Sherbrooke.—The Canadian Connecticut Cotton Mills are erecting a four-storey addition at an estimated cost of $50,000.

Three Rivers.—It is reported that American capitalists propose to erect a beet sugar factory in this district.

England.

The British Government has invited the Institution of Electrical Engineers to put forward suggestions for ensuring the safety of operators engaged in electric welding. This circumstance, combined with the approval by Lloyds of electric welding for ships' hulls under certain

conditions, is a proof that this process of jointing steel will prove a formidable rival of riveting.

United States.

Wyoming.—The thickest oil-bearing sand known in the United States has been discovered in the Big Muddy field in Wyoming State, where the Merritt Oil Corporation, in drilling in the second Wall Creek sand, have penetrated more than 265 feet.

Foreign.

Switzerland.—It is stated that the three chief Swiss color-making firms—the Society of Chemical Industry, J. R. Geigy & Co., and the Sandoz Chemical Works—are considering the terms of an agreement under which, for a long time, profits, processes and patents would be pooled, each firm retaining its individual management.

THE CHEMICAL EXPOSITION AT CHICAGO.

There is an increasing interest on the part of Canadian chemists and metallurgists in the National Exposition of the Chemical Industries. As already announced, the fifth annual show will this year be held in the Coliseum, Chicago, beginning September 22. It is expected that one or more departments of the Dominion Government will be represented, besides exhibits from some of the provinces. The Ontario Government will have an exhibit which it is anticipated will eclipse the wonderfully varied display of minerals and metal shown in New York last year, while the industries of Shawinigan Falls, Que., will combine to exhibit a full assortment of the products, which, taken together, made the most remarkable display of last year's exhibition. Other entries that are expected will fill every space allotted to Canada. Among these the Canadian Chemical Journal will be represented in a booth, to which all Canadian and American visitors are welcome.

It is expected that for the first time some chemical processes will be shown in operation. The meetings of various societies, mentioned last month, and the daily motion pictures and conferences will greatly add to the educational value of the Exposition.

The Chicago offices of the Exposition directorate will be at 417 South Dearborn Street. The popular managers, Charles F. Roch and F. W. Payne will be in charge.

BETTER UTILIZATION OF B.C. COAL.

Mr. F. W. Glover, of Penticton, in an address delivered at the mining convention in Vancouver in March, emphasized the importance of Canada's deposits of iron and coal. The growth of population in modern times, Mr. Glover affirmed, followed the output of coal and iron, and not agriculture. Before maximum results could be achieved from British Columbia coal areas, a broad vision and greater interest would have to be shown by the Government or people, the coal operators, labor, railways, and banks. Coal land, he contended, should be leased only to people who commence operations and actual mining in a reasonable time after they acquire the mining rights, thus preventing speculators holding up the development of these areas, something too common in our business life. The Government should have a board of control over the mine operators and laborers to see that both get fair play. Both sides—operators and labor—should be willing to refer disputes to such a board and to abide by its decisions. The fact that many of the railways or their subsidiary companies, operated coal mines, water powers, etc., was very serious competition for private enterprise to contend with, and manifestly unfair, and the railways should be made to toe the mark, and to provide transportation of freight from mines at reasonable rates. The banks should have a special department with mining advisers to handle loans to bona fide mining operators; a step in the direction of banking progress, and of great advantage to the mining industry.

NEW PROCESS FOR PIGMENT MANUFACTURE.

Installation of machinery for the manufacture of pigments has been under way in a chemical plant at Salt Lake City, Utah. Lead and zinc sulphide ores will be treated by a newly patented process yielding white lead, chromate of lead, arsenate of lead, Prussian blue, sulphuric acid, nitric acid, nitroglycerine, printers' ink and sulphur. Ores containing lead and sulphur, etc., are treated in acid-resisting tanks in acid solution, the nature of which solution has not been disclosed, except that it has a nitric acid base. The ores are crushed fine for the treatment. Mechanical agitation of the mass follows for six hours with water heated to a certain degree, the batch being then filtered.

With the chromes and nitrates, fine yellows may be made for paint, and it is claimed that all the materials necessary for a full line of colors in all shades and tints can be produced direct from the simple chemical processes which the company owns at a cost that will make competition impossible. It is claimed that combinations of colors for painting can be furnished on short notice to match any similar combinations of colors previously put out, thus eliminating uncertain and vexatious attempts to match shades. The inventor also contends that nitric acid is made in the process from low-grade nitrates at trifling cost, as compared with other processes, and that arsenic is recovered from arsenious ores in one operation.

ANNOUNCEMENT.

Wm. B. Scaife & Sons Company, of Pittsburgh, announce the opening on July 1st of a Chicago Sales and Engineering Office at 38 South Dearborn Street, with Charles F. O'Hagan, formerly Chief Engineer of the Company at Pittsburgh, as Resident Engineer and Manager.

This Company is the oldest manufacturing concern west of the Alleghany Mountains. During the more than one hundred years since their business was founded they have from time to time, as conditions arose, added to their manufacturing facilities. They now manufacture Black or Galvanized, Riveted, Brazed or Welded Steel Tanks for air, gas and liquids, Steel Shipping Drums, Range Boilers, Steel Structures, also the well-known We-Fu-Go and Scaife Water Softeners and Filtering Equipment.

PLATINUM IN EBY TOWNSHIP.

The interesting and possibly important discovery has been made that platinum occurs in encouraging quantities in Eby township in Northern Ontario. Samples taken from a large sulphite deposit on a group of claims in Eby have been found to contain a very high percentage of sulphur, as well as very encouraging quantities of gold and of silver, the latter sometimes occuring in commercial quantities. Up until quite recently no test for platinum has been made. As a result of the first and only test so far made, the ore has been found to contain about $2 per ton in platinum.

Summary of Chemical Statistics

Recently Available Statistics Relating to Canadian and United States Chemical Industries

THE Statistics Branch of the Department of Trade and Commerce, Ottawa, has at last begun to realize the value of certain data relating to a number of industries which had not previously received due attention. The results of this work will shortly appear for general distribution among business men, who we believe will be very much interested. At the same time the United States Government has put forth its first real report covering chemicals and allied products used in the United States. This bulletin comes in Miscellaneous Series No. 82 from the Department of Commerce, Washington. Both the American and Canadian Governments have been urged along in this work by Societies of Chemists. The American Chemical Society in the United States and The Society of Chemical Industry in Canada, along with the Advisory Research Council, have pressed for this assistance, and now the facts are available in such a form as will be helpful to business men in these lines.

The distribution of Canadian chemical industries may be understood from a survey of the location of some 634 plants engaged in chemical or allied operations.

	Plants.
Nova Scotia	30
Prince Edward Island	2
New Brunswick	20
Quebec	161
Ontario	293
Manitoba	38
Saskatchewan	8
Alberta	21
British Columbia	61
	634

The remarkable growth of the chemical industries of Canada since 1912 is shown below.

Table No. 1.—Exports of Canadian Drugs, Dyes and Chemicals for the Fiscal Years 1912-1919.

Year.	British Empire.	Foreign.	Total.
1912	$ 827,500	$ 849,716	$1,677,216
1913	1,066,158	734,279	1,800,437
1914	841,566	888,637	1,730,203
1915	955,156	2,588,545	3,543,701
1916	1,398,832	5,050,313	6,449,145
1917	1,719,972	7,498,443	9,218,415
1918	2,765,292	11,442,317	14,207,609
1919	4,300,142	12,752,932	17,053,074

During the same period imports were enormously increasing, more particularly, of course, from the United States. Some idea of the possible and future market Canada has to offer foreign manufactuerrs may be gained from a study of the data given below, while every encouragement should be gathered by those contemplating entering the field of Canadian resources directly through a Canadian plant.

Table No. 2.—Imports of Drugs, Dyes and Chemicals from 1912-1919.

Year.	British Empire.	Foreign.	Total.
1912	$2,806,555	$ 9,789,296	$12,595,851
1913	3,417,468	13,093,875	16,511,343
1914	3,201,277	11,437,012	14,638,289
1915	2,878,322	10,570,745	13,449,067
1916	3,034,277	14,060,648	17,094,925
1917	4,873,226	22,726,987	27,600,213
1918	3,636,024	22,886,148	26,522,172
1919	4,003,513	28,785,191	32,788,704

The classification of Custom returns leaves much to be desired from the viewpoint of the manufacturer having chemical industries in mind. The technical man has not yet found his proper place in some Government departments, and we have people classifying data who know very little about the significance of their work. A good start has been made and in time more detailed information will be available, and probably will find an increasing number of people willing to make some use of it.

The recent American census is valuable as a start, and gives the first opportunity for really studying the situation as it existed in 1913-14. A remarkable effort is going on to make the United States absolutely independent of foreign countries as far as possible, and with a few exceptions, where they have not the essential raw materials, this end may be readily reached. Even in 1913-14 Canada was able to make a respectable showing, having exported to the United States 6 per cent. of her total crude imports of chemicals. This amounted to $11,840,612 out of a total of $197,343,535. Of this total amount England sold 24 per cent., Germany 15 per cent., Chile 10 per cent., Brazil 9 per cent., and Belgium 8 per cent. It is possible that some confusion and misunderstanding might arise in the minds of some when considering certain items. While Canada is credited with an export business to the United States of $1,678,736 in crude asbestos, importations of nickel amounted to less than $100. If chemical independence is a worthy aim for the United States it should also be a live issue here, and while the supposed superhuman difficulties of refining nickel and cobalt in Canada have been overcome since 1913 we still sell our asbestos crude and buy it manufactured or have other countries forward it to all parts of the world.

A summary of general trade statistics in chemical products in the United States will always have a direct bearing on Canadian development, and we give below a summary report of conditions in 1913.

Table No. 3.—Imports, Domestic Production and Exports of Chemicals from the United States in 1913-14.

	Imports.	Domestic Production.	Exports.
Abrasives	$ 843,881	$9,152,000	$2,127,945
Asbestos	1,678,736	2,814,000	.....
Baking powder	.....	17,870,674	790,274
Blacking and other polishes	41,559	9,882,000	649,395
Bronze powder	406,649	.....	.....
Candles	40,004	3,696,068	283,018
Chalk	157,959	.....	40,154
Chemicals	48,278,293	173,269,000	19,859,009

Clays	1,985,006	190,688,000	3,923
Coal-tar products	8,818,944	220,238,000	35,359
Drugs	7,672,291	8,080,000	2,798,286
Dyeing materials	995,191	20,620,000	370,676
Explosives	.....	39,645,382	2,785,633
Fertilizers	28,038,709	153,196,000	12,111,108
Gelatins and glues	2,699,539	13,733,000	306,111
Greases and tallows	1,726,971	29,820,000	5,049,814
Gums and resins	88,903,829	205,282	3,790,874
Inks and ink powders	46,821	16,859,180	625,074
Medicinal preparations	1,289,608	150,473,000	6,788,806
Oil cakes	117,104	2,191,610	21,667,672
Oils, animal	1,033,851	51,380,313	851,142
Oils, mineral	13,233,057	362,573,653	124,322,660
Oils, vegetable	43,467,881	192,365,100	15,913,901
Oils, essential	3,552,692	2,565,361	783,629
Petrolatum	.....	1,243,388	661,889
Pigments	2,240,320	27,386,665	3,728,331
Paints	20,836	70,582,461	1,104,971
Varnishes	64,066	36,142,256	1,038,864
Perfumes, cosmetics and toilet preparations	2,309,827	19,160,407	1,638,841
Salt	423,322	34,804,683	550,380
Soap	788,570	106,994,620	4,941,707
Sulphur	424,909	2,676,395	2,018,923
Tanning materials	4,228,214	7,123,971	876,257
Turpentine and rosin	28,818	21,463,890	19,882,165
Waxes	1,923,328	8,897,106	6,622,487
Total	$267,480,785	$2,017,794,065	$265,019,278

Canadian Exports to the United States.

While Canadian imports are not available for the period in question, an idea may be gained of the nature of Canadian exports to the United States at this period, as listed in the Report of the Bureau of Commerce, Washington.

Table No. 4.

Article	Total U.S. Imports, 1913-14.	Percentage Received from Canada.
Corundum ore	$ 39,772	58.8
Corundum, grains	61,026	59.2
Crude Abrasives	233,799	36.2
Emery	33,874	0.1
Rottenstone	21,206	19.5
Antitoxin	21,509	2.2
Tuberculine	21,223	2.1
Asbestos	1,678,736	99.8
Beeswax	477,695	1.5
Balsam, fir	12,769	38.9
Blood, dried	391,947	4.9
Chalk, precipitated	39,334	1.5
Acetone oil	14,609	100.0
Arsenious acid	110,168	30.9
Hydrochloric acid	1,450	100.0
Oxalic acid	425,008	0.3
Sulphuric acid	41,874	99.4
Ammoniacal liquor	5,531	100.0
Ammonium perchlorate	6,384	0.1
Ammonium sulphate	4,888,563	7.3
Ashes, wood and beetroot	28,026	92.1
Barium sulphocyanide	3,325	3.0
Carbon tetrachloride	28,322	0.3
Cobalt oxide	95,299	93.7
Formaldehyde	1,505	2.2
Fusel oil	910,739	1.0
Glycerine, crude	4,486,415	3.7
Iron, oxide	15,229	2.7
Casein	705,264	2.9
Magnesite, calcined	1,473,007	0.3
Mercury	192,768	0.1
Mineral salts (evaporated waters)	40,856	0.6
Platinum, unmanufactured	1,489,208	1.3
Quinine sulphate	515,581	0.2
Sodium carbonate (crystals)	3,396	11.8
Sodium chloride (salt)	423,322	7.0
Sodium phosphate	25,007	33.0
Sulphur	13,638	6.4
Terpin hydrate	2,052	7.7
Viburnin	127	100.0
Zinc dust	228,163	3.3
China clay	1,577,747	0.8
Coal tar, crude	24,500	98.8
Creosote oil	3,839,062	1.1
Amarin	1,005	100.0
Benzaldehyde	373	15.2
Nitraniline	1,037	100.0
Trinitrotoluol	58,561	0.8
Cassia	200,895	36.7
Cassia buds	1,218	50.0
Castoreum	3,520	90.1
Linseed	10,571,410	99.9
Elder flowers	882	15.5
Ginseng	14,476	67.9
Mustard seed, ground	240,567	0.1
Rhubarb, high-dried	22,354	49.8
Sandalwood	139,682	41.2
Senega root	4,030	99.0
Cutch	16,187	1.7
Hemlock bark	25,655	100.0
Nutgalls	177,868	51.1
Bone ash	1,034,636	13.6
Calcium cyanamide	1,601,090	99.7
Phosphates, crude	177,964	0.1
Basic slag	108,762	0.2
Tankage	246,935	55.5
"	404,755	31.4
Glue	11,805,543	0.3
Greases—		
Fleshing	1,402	100.0
Soap-making	51,957	96.2
Tallow	577	100.0
Gums and Resins—		
Chicle, crude	2,930,117	15.3
Camphor, refined	182,802	1.1
Rubber, scrap and for remanufacture	2,063,198	20.1
Spruce gum	1,432	78.2
Incense	24,803	87.0
Oils—		
Cod	383,016	37.4
Cod liver	263,597	0.6
Fish oil	155,827	33.9
Oleo	401	100.0
Whale oil	103,970	73.3
Edible oils	8,203,011	0.2
Mustard oils	10,123	4.3
Lithopone	248,549	2.5
Whiting	11,353	6.9
Gypsum, crude	482,529	97.8
" ground	30,214	89.9
" pearl hardened	5,294	3.3
Graphite	1,846,126	6.2
Polishes	7,337	10.8
Talc, ground	148,523	24.7
" unground	23,369	0.5
Wood tar	7,946	30.5
Turpentine spirits	28,818	4.8
Wax, mineral	543,103	6.7
" vegetable	1,049,176	1.6

These constitute the principal items in which any business was done with the United States in 1913. In a general way it is known what developments have taken place since that time. From Tables Nos. 1 and 2 it will be seen that Canadian exports, as well as imports, have increased greatly. From a consideration of data above, as well as the full report of Dr. E. R. Pickrell in Miscellaneous Series No. 82, the possibilities for trade developments in the United States may be seen. Germany certainly controlled chemical markets in the United States and Canada. Full information of more recent date may be had in special cases, as far as Canada is concerned, and there is now no reason why anyone should not be able to follow intelligently trade developments in chemicals.

Canadian exports were at least ten times greater last year than they were in 1913-14, and while much war business may have gone, the chemical industries established here during that period will find a solid foundation for business in the rapid development of resources, the increase in population, and the foreign markets open to so many Canadian products.

RECENT CHANGES IN CANADIAN TARIFF REGULATIONS RELATING TO CHEMICAL AND METALLURGICAL PRODUCTS.

British preferential tariff is designated first, intermediate tariff second, and general tariff third, and rate as listed below is given in the above order for quantities specified:

210. Peroxide of soda; soda, sulphate of, crude, known as salt cake; silicate of soda in crystals or in solution; bichromate of soda; nitrate of soda or cubic nitre; sal soda; sulphide of sodium; nitrite of soda; arseniate, binarseniate, chlorate, bisulphite and stannate of soda; prussiate of soda and sulphite of soda, per pound, free, free, free.

210b. Barilla or soda ash, per pound, one-fifth cent, three-tenths cent, three-tenths cent.

267a. Crude petroleum in its natural state, .7900 specific gravity or heavier at 60 degrees temperature, when imported by oil refiners to be refined in their own factories, free, free, free.

290. Cement, Portland, and hydraulic or water lime, in barrels, bags or casks, the weight of the package to be included in the weight for duty, per 100 pounds, 5 cents, 8 cents, 8 cents.

329a. Iron ore, free, free, free.

337. Lead, old, scrap, pig and block, per pound, ¾ cent, 1 cent, 1 cent.

343. Tin, in block, pigs or bars; tin strip waste, and tin foil, free, free, free.

345. Zinc dust, sheets and plates; sal ammoniac skimmings; and seamless drawn tubing of zinc, free, free, free.

345a. Zinc spelter and zinc in blocks, pigs, bars or rods, per pound, ¾ cent, 1 cent, 1 cent.

348. Copper in blocks, ingots or pigs, per pound, 1 cent, 1½ cents, 1½ cents.

348b. Brass and copper scrap, free, free, free.

348c. Brass in block, ingots or pigs; copper in bars or rods, not less than six feet in length, unmanufactured, n.o.p.; copper in strips, sheets or plates, not polished, planished or coated; brass or copper tubing, in lengths not less than six feet, and not polished, bent or otherwise manufactured, 5 p.c., 10 p.c., 10 p.c.

348d. Copper in bars or rods when imported by manufacturers of trolley, telegraph and telephone wires, electric wires and electric cables, for use only in the manufacture of such articles in their own factories, free, free, free.

356. Nickel in bars and rods, strips, sheets or plates, free, free, free.

356a. Nickel silver and German silver in bars, rods, strips, sheets, plates and anodes, 5 p.c., 10 p.c., 10 p.c.

384. Rolled iron or steel sheets and strips, polished or not, No. 14 gauge and thinner, n.o.p.; Canada plates; Russia iron, terns plates and rolled sheets of iron or steel, coated with zinc, spelter or other metal of all widths or thicknesses, n.o.p.; and rolled iron or steel hoop, band, scroll or strip, No. 14 gauge and thinner, galvanized or coated with other metal, or not, n.o.p., 7½ p.c., 12½ p.c., 12½ p.c.

384a. Rolled iron or steel hoop, band, scroll or strip, No. 14 gauge and thinner, and rolled iron or steel sheet, when imported by manufacturers for use only in their own factories in the manufacture of galvanized iron or steel hoop, band, scroll, strip or sheet, free, free, free.

GERMAN CHINA FOR UNITED STATES.

German trading interests are already making arrangements for the importation into the United States of German and Austrian china and earthenware, according to The Board of Trade Journal, London, Eng. Interviews have taken place in New York to arrange for the handling of these goods, the German representatives contending that there will be a considerable market for these goods if they can be bought at a cheaper price than English, Japanese or domestic goods. It is reported that one German agent has already made plans to handle a large quantity of china, and that the goods will be marked "Made in Bavaria," or "Made in Bohemia," as it is believed that the buying public can easily be persuaded that neither of these countries was responsible for German aggression.

OPAL PRODUCTION IN AUSTRALIA.

In 1915 a valuable opal field was discovered in the Stuart Range, Australia, north by east of Tarcoola. Opal has already been discovered in this field in an area 10 miles long, and a maximum width of two miles, and further extension is assured when a water supply is available for the use of prospectors. The South Australian Government Geologist, in a report, states: "The discovery of precious coal at Stuart Range is probably the most important mineral discovery that has been made in South Australia for many years."

COCAINIE, OPIUM, AND SALTS RESTRICTIONS.

An Order-in-Council was passed at Ottawa on May 14th inst. prohibiting the importation into Canada, except under license issued on the recommendation of the Minister of Trade and Commerce, of cocaine and its dry salts, and preparations, opium and its preparations, and opium alkaloids and their salts and preparations.

THE RAMSAY MEMORIAL FELLOWSHIP.

The establishment of a fellowship by the Honorary Advisory Council for Scientific and Industrial Research, Ottawa, to be known as The Ramsay Memorial Fellowship for research work in chemistry, has created much favorable comment from Canadian chemists. The fellowship will be a one-year appointment, and the holder will be required to carry on research work in some chemical laboratory in Great Britain which has been approved of by the Research Council. The value of the fellowship is $1,500. The award will be made on or before the fifteenth of this month (July) to the best of the candidates in chemistry who have already successfully completed their research in some chemical problem of importance. Dr. A. B. Macallum, of the Council, Ottawa, will receive applications.

TORONTO UNIVERSITY APPOINTMENTS.

The following members of the personnel of the University have been promoted in the Applied Science, Arts and Medicine faculties:

F. B. Kennick, professor of chemistry.

F. B. Allan, professor of organic chemistry.

Andrew Hunter, from assistant professor of chemical pathology to professor of biochemistry from July 1, 1919.

Dr. V. E. Henderson, professor of pharmacy and pharmacology-medicine.

H. W. Price, professor of electrical engineering, applied science.

S. L. Parsons, associate professor of mineralogy.

R. H. Williams, associate professor of history.

G. M. Smith, associate professor of history.

Dr. W. B. Hendry, associate professor of obstetrics and gynaecology, medicine.

Dr. Gilbert Royce, assistant professor, laryngology, medicine.

C. R. Young, associate professor, applied mechanics, applied science.

T. R. Loudon, associate professor, Ferto metallurgy, applied science.

W. M. Treadgold, associate professor, surveying, applied science.

E. G. R. Ardagh, associate professor, chemical engineering.

A. W. McConnell, associate professor, architecture, applied science.

Arts—T. R. Pounder, assistant professor, mathematics.

Arts.—H. A. McTaggart, assistant professor, physics.

Arts.—A. MacLean, assistant professor, geology.

Arts.—J. T. Burt-Gervans, assistant professor, electro chemistry.

Arts—W. A. Clemens, assistant professor, elementary biology.

Arts.—A. F. Coventry, assistant professor, vertebrate embryology.

J. J. Traill, assistant professor, applied science, hydraulics.

S. R. Crerar, assistant professor, surveying, applied science.

The following lecturers at the University have received appointments to the University staff as follows:

Ellis Thomson, Arts lecturer in mineralogy.

W. S. Funnell, chemistry.

E. H. Craigie, comparative anatomy, biology.

G. H. Duff, M.A., botany.

Mrs. W. K. Fraser, lecturer in physiology.

Dr. E. J. Pratt, lecturer in psychology (substituted).

Dr. E. A. Bott, lecturer in psychology, war service.

Dr. C. G. Imrie, pathological chemistry.

Medicine.

Dr. A. Brodey, demonstrator pharmacy.

Dr. R. D. Defries, hygiene.

Applied Science.

W. S. Guest, electrical engineering.

A. R. Zinmer, electrical engineering.

J. H. Billings, machine design.

J. H. Parkin, thermodynamics.

F. C. Dyer, mining engineering.

J. T. King, mining engineering.

E. W. Manting, surveying.

H. H. Madill, architecture.

W. J. Smither, drawing.

Household Science.

Miss L. L. Ockley.

Miss H. Hill.

Miss E. M. Hickmans.

Miss E. V. Millar.

Miss Florence Draper, B.A., Fort Akinson, Wisc., $1,000.

Miss Edna Park, B.A., laboratory assistant and research workers' household science, $750.

Miss Francis J. Tufford, B.A., $750.

Miss C. W. Harwood, B.A., food chemistry, $750.

Miss E. F. D. Martin, B.A., assistant, food chemistry.

Medicine.

Dr. R. D. Defries, associate director, antitoxin laboratory.

Dr. A. H. Caulfield, research associate, Connaught antitoxin laboratory, $1,500.

Dr. D. T. Fraser, research assistant, Connaught antitoxin laboratory.

Dr. J. D. Barton, physical director, $500.

CATALOGUES AND REPORTS RECEIVED.

1. "Abstracts of Current Decisions on Mines and Mining." J. W. Thomson, Department of Interior, Washington. Bulletin 179. Law Serial 18. A very useful summary of mining decisions.

2. "Concentration of Nature Sulphur Ores by Flotation." J. M. Hyde, Bureau of Mines, Washington.

3. "Cost of Producing Ferro-grade Manganese Ores," by C. M. Weld and W. R. Crone, Bureau of Mines, Washington.

4. "Use of Manganese other than for Steel-making." W. C. Phalen, Bureau of Mines, Washington. The use of manganese in dry cells, the ceramic industries, the use of manganese salts as driers, and the function of manganese bronze are discussed.

The Norton Company of Worcester, Mass., have issued a sixty-page illustrated catalogue descriptive of their refractories. The cuts of the different articles are well shown in clear black and white, nothing better in such engraving having passed our notice for some time. Lymans, Limited, Montreal, distributors of these goods, may be applied to for copies of these catalogues.

The Hamilton Motor Works, Limited, 191 Barton Street East, Hamilton, Ont., have issued a catalogue descriptive of their hand oil pumps. Where oil is drawn from a barrel by means of a faucet there is always more or less of a drip, and the floor soon becomes oil soaked, thereby increasing the fire hazard and causing a loss of the oil as well. With these hand oil pumps, the catalogue explains, any desired quantity may be drawn from the barrel, and the oil-soaked floors and waste of oil is prevented.

Grinding Wheels.—Dominion Abrasive Wheel Co., Ltd., Mimico, Ont. An illustrated booklet of 96 pages, showing wheel designs and describing various processes for manufacturing artificial abrasives.

National Drug News.—A house organ of the National Drug and Chemical Co. Carries the local drug news by provinces.

Mineral Foote Notes.—Twice a month by the Foote Mineral Co., Inc., Philadelphia. Extracts from literature on some of the less common ores handled by this company.

Electric Resistance Furnaces.—Hanovia Chemical and Manufacturing Co., Newark, N.J. A well-arranged catalog showing laboratory furnaces, quartz, glass, thermometers and quartz lamps.

NEW YORK LETTER.

New York, June 25, 1919.

The summer meeting of the American Institute of Chemical Engineers was held at Boston, Mass., June 18th, 19th and 20th. The opening meeting was held at the Engineers' Club, President Arthur D. Little being in the chair. An address of welcome was given by Mayor Peters, of Boston. The principal item in the program was a symposium on industrial electric furnaces.

Dr. Little in his opening address expressed the opinion that the developments in the chemical industry to-day and during the war period were only the beginning of much greater developments in industrial chemistry in the immediate future. Dr. Little pleaded for a closer connection between bankers and industrial leaders and chemical experts.

A paper on "The Future of the Electric Furnace," by C. G. Bragg, of the Michigan Smelting and Refining Company, expressed the opinion that the electric furnace would soon assume the same importance in the field of non-ferrous metallurgy that it has in the metallurgy of iron and steel.

Dr. Gillette, of the Bureau of Mines, spoke on the subject of Electric Furnaces in the Brass Industry. He stated that the number of firms in the United States using electric brass furnaces is constantly on the increase, about forty firms using them at present. Development in this direction is largely dependent on the cost of power, which must be low and uniform.

T. E. Bailey, of the Electric Furnace Company, gave a paper on "Electric Furnaces of the Resistance Type." E. L. Crosby, of the Detroit Furnace Company, dealt with the "rocking arc" type of furnace, for which he claimed great simplicity in design and operation.

After a luncheon at the Engineers' Club, the proceedings were resumed, papers being given by G. H. Clames, of the Ajax Metal Co., and Dr. E. F. Northrup, of the Palmer Physical Laboratory, Princeton.

As Dr. Northrup was unable to be present, his contribution was read by C. T. Bragg. In this paper it was pointed out that great developments were to be expected along the line of high frequency induction furnaces. The paper dealt very thoroughly with the appliances necessary for supplying current for such purposes which has given rise to a number of new problems which electrical engineers are meeting very successfully. Tubular resistors of tungsten, consisting of a number of rings, have been made which can be heated to temperatures in the neighborhood of 3,000° and which entirely eliminate the presence of carbon. These tubular resistors are insulated on the outside with a very pure form of zirconia.

Mr. G. H. Clames dealt with the "Ajax-Wyatt Induction Furnace."

Mr. N. S. Towle, of the Westinghouse Electric and Manufacturing Company, gave a talk on "Electric Considerations of the Electric Furnace Installation."

A smoker was held on Wednesday evening at the new laboratory of Arthur D. Little, Inc., in Cambridge, on which occasion the visitors inspected the building, the museum and the miniature paper mill which is the most efficient installation of the kind in the world. Thursday was devoted to a number of trips of inspection to various industrial plants in the Boston district. On Thursday evening a dinner was given at Marblehead, after which Dr. C. G. Gilbert gave a paper on "Reconstruction."

At the Friday morning session, President Little opened the meeting by requesting the members of the Institute to turn their attention to the development of the natural resources of the country and the problems in that line now confronting the government. Dr. Little pointed out that it was quite possible for the United States to double its agricultural production since there is an immense amount of land in the country entirely suitable for farming which only has to be cleared. This is true even in the section along the Atlantic seaboard, which is generally regarded as having been pretty intensively developed. It was pointed out that the railroads are by no means in a high state of efficiency and that natural waterways are hardly made use of at all, in spite of the large sums which have been expended on them. Coal is almost exhausted, only about 190 tons of anthracite coal remaining per capita. We have wastefully abandoned oil wells when only 50 per cent. exhausted. Everybody knows the wasteful manner in which our forests have been utilized. Great attention should be given in the immediate future to the development of better highways which affects every branch of industry. Dr. Little expressed himself as not being in favor of government ownership. He considered, however, that a certain amount of government supervision is available. The following resolution was adopted by the Institute: "Resolved, that the American Institute of Chemical Engineers urgently recommend the appointment of a High Commission to formulate and carry into effect a comprehensive and general plan for the development of our natural resources."

Dr. Palmer, of the Department of Agriculture, spoke on the utilization of wool-scouring grease. He pointed out that this material was being sold to farmers for fertilizer on account of its high potash content, which is a wasteful means of disposing of it.

Edward Gudeman, of Chicago, gave a paper on "The Licensing and Registration of Chemists." Dr. Gudeman maintained that chemists should be licensed in the same manner as physicians, lawyers, etc. This, he said, would prevent firms and individuals in need of chemical services placing themselves in the hands of unlicensed and irregular "experts." Dr. James R. Withrow, of Ohio State University, spoke in opposition to this plan. He believed that there was too much legislation with regard to the licensing of professions. Mr. A. W. Smith took a similar position.

Dr. A. C. Langmuir, of Cleveland, pointed out that a great many scientific men had joined the American Federation of Labor, and pleaded for the organization of labor unions amongst industrial scientists. He maintained that this not only would benefit the industrial scientists, but would make for better relations with union labor. Secretary John C. Olsen pointed out that there was no particular connection between the question of labor unions and the question of professional licensing. President Little stated that he would be very sorry to see chemical engineers and chemists having anything to do with labor unions.

Mr. W. H. Russell contributed an interesting paper on "The Development of the Providence Gas Company's Plant." Friday night there was a dinner at the Boston Country Club and on Saturday the members took part in various automobile trips, etc., provided for their entertainment. It was decided to hold the next meeting, which will take place in December, at Savannah, Ga.

There has been considerable excitement in chemical circles in New York over the rumor that Dr. Hugo Schweitzer, formerly chief chemist of the Bayer Company, who was reported to have died some months ago in New York, had not really died at all and was alive in Mexico. The facts in the case tend to give some support to these rumors. The burial certificate was signed by a German doctor. The

day previous to Dr. Schweitzer's alleged death he was known to have been in the best of health and his death is attributed to a form of pneumonia which generally takes much more than twenty-four hours to become fatal. People who called at Dr. Schweitzer's home on Riverside Drive to pay their respects, were turned away and the funeral was very quietly and hastily conducted. The body was alleged to have been cremated. Shortly after Dr. Schweitzer's alleged death, it was proved that he had been connected with activities of the German government in America in a very sinister fashion. It has been pointed out in a recent number of the Journal of Industrial and Engineering Chemistry, that whether dead or alive, Dr. Schweitzer's career as a chemist is at an end in America owing to his objectionable activities as an agent of the German government.

F. M. TURNER, JR.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

Conditions generally have been a little quieter in the chemical trade during the past few days. This is due to the fact that the summer season has come upon an already none too active spring. The summer months, July and August, are always, even tn the best of years, a quiet period. Managers and directors take their holidays, plans for reorganization and expansion are left in abeyance for execution until the fall. Undoubtedly, too, the labor conditions throughout Canada have had a hindering effect on the chemical business, as they have had on many others. Directors and officials are just a little wary of spending money for any expansion until the troubles of labor are settled. And this is certainly wise and safe. It is unfortunate, though, that the disputes of real labor with employees cannot be settled without the clamorings of the I.W.W.'s and foreign and other loud-mouthed agitators beclouding the real issue.

Heavy Chemicals.—The trade in caustic soda is worthy of special note in the United States, where recently the export business has experienced a decided advance. The old export business seems to be coming back, and the middleman, with his second-hand produce, is almost eliminated from the general trade in heavy chemicals.

Sulphuric Acid.—The Canadian trade in sulphuric acid has been just steady enough to hold, but is gradually getting firmer.

Tartaric Acid.—Tartaric crystals have advanced ten cents a pound during the month, due to increased demand for the soft drink trade. On account of citric acid being somewhat scarce tartaric is taking its place in many beverages.

Prices on the whole have remained about stationary during the month on chemicals. Slight drops have occurred in zinc sulphate, sodium benzoate, crude sodium nitrate and sodium acetate. There was a rise noticed in ammonium carbonate, which now sells at 30 cents per single pound from wholesalers.

Rubber.—The rubber industry in Canada is making good advances. An inspection of the different plants reveals the fact that business is brisk. Especially is this true of what are known as perhaps the smaller organizations and plants. This industry is so closely allied with chemistry as to be almost known as a chemical industry. We hope in the near future to have "something good" for our readers on the rubber industry.

Salvarsan.—After considerable delay and hesitation on the part of officials at Ottawa the Provincial Board of Health for Ontario has been granted a license to manufacture and sell salvarsan. The Canadian product, while being of very high grade, has been held at a much higher price than it is expected will be charged by the Provincial Department.

METALS.

Iron and Steel.—There has been little headway made in the advance for steel demand that was noticeable during the second half of May. The movement has gained only slightly during June, but, on the other hand, the steel market has held. The bottom has not dropped out, as some feared it might some months ago, due to the tendency of dealers to cut prices. This tendency is still noticeable in the United States, but, fortunately, does not exceed more than from a dollar to four dollars a ton. A strong note of optimism was made by President Mark Workman, of the Dominion Steel Corporation, at the company's annual meeting, held on June 16 at Montreal. Regarding the outlook for the marketing of the products he said it was evident that at the present time the attitude of purchasers of steel products was one of conservatism, but had every hope that the near future would bring a revival in the industry. Undoubtedly a tremendous purchasing power existed in the absolute depletion of stocks throughout the world. It was not to be expected, however, that the margin of profit would be as great as in the past year, as competition was becoming keener and production costs remained abnormally high.

Asbestos.—Eighty-five per cent. of the world's supply of asbestos comes from the asbestos mines in the Eastern Townships of Quebec Province. Unlike other minerals that were urgently needed during the war, asbestos will continue to be in demand for purposes of reconstruction. The asbestos fibre produced in Canada during 1918 was given a valuation of $8,000,000 as it left the mills. The finished product was valued at $70,000,000. The output both in tonnage and value in Canada for 1918 was the largest on record. There were 2,445,745 tons of rock mined in 1918, the fibre content varying from 1½ to 12 per cent. The average ton of rock in 1918 gave $4.06 of asbestos, compared with $3.08 produced in 1917. Unfortunately, as is the case with several other Canadian products, the bulk of the finished product is made in the United States and our needs imported again from there. As high as $1,600 per ton was paid for No. 1 crude asbestos during 1918. At present the industry is receiving a good supply of orders, and a much better production is expected during 1919 than was expected.

OILS.

During the past month the thoughts of many interested in oil have turned to the Peace River district in North-West Canada. Several parties of about thirty men to a party have entered this district recently on exploration expeditions for oil, as it is the belief of many engineers that Canada is about to hear of one of the largest discoveries of a natural resource that it has yet known. Should these exploration parties prove successful, and there is sufficient actual scientific data from smaller parties to confirm the belief that they will, we will certainly have the basis formed for a great development work in this district that will attract many prospectors and companies.

Gasoline.—The price of motor gasoline has dropped one cent a gallon during the past month, due to the removal of the 7½ per cent. war tax on the crude oil. This makes the price of gasoline at 32 cents per gallon in barrel lots from the refiinery, or 35 cents if bought at service stations.

Turpentine.—Prices for spirits of turpentine are still abnormally high, the wholesale price from jobbers at Toronto and Montreal now runnig from $1.55 to $1.60 per gallon in barrel lots. The continued heavy demand from abroad, with the result that no opportunity is afforded the industry in South America to accumulate stocks, is given as the reason for this advance in price. London, England, is reported to be the heaviest buyer in the market.

Linseed Oil.—It remains for linseed oil, however, to reach hitherto unknown heights of price, having jumped 15 to 20 cents per gallon during the month from an already high figure. The wholesale price at this writing

is from $2.30 to $2.35 per gallon for the raw linseed in barrel lots. This is the highest price that has been known in the history of the business. The main cause of this high quotation is the difficulty experienced by the trade in getting flax seed from Argentina. Not only is there a scarcity of the Argentina seeds, but dock strikes at Argentina ports have held up shipments. In addition to this the paint trade in Canada is calling for large quantities of linseed oil, there being a decided boom on at present in paints, due, no doubt, to the fact that many are undertaking long-thought-of decorating work following the end of hostilities and the settling back to more normal living conditions.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	.90
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.05½—.06½
Acetic acid, refined	Lb.	.21½—.22½
Acetone	Lb.	—15¼
Aspirin, in 100-lb. lots	Lb.	1.35—1.60
Alchohol, pure, bbl., 65% O.P.	Gal.	8.75
Alcohol, methylated, bbl.	Gal.	1.95
Alcohol, wood, 95%, refined, bbl.	Gal.	1.60—1.70
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.10—.12
Ammonium Carbonate	Lb.	.30
Ammonium Chloride	Lb.	.15—.20
Benzoic Acid	Lb.	1.50
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per Ton	$25—$30
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda,ground, bbl.	Lb.	.04½—.05
Chloroform	Lb.	.45—.60
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitrol)	Lb.	.09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.22
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¼—.04
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Potassium Bromide	Lb.	—.75
Potassium Nitrate, kegs	Lb.	.24—.26
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.25—3.50
Salicylic Acid	Lb.	.45—.60
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.14—.16
Sodium Cyanide, bulk, 98-99% in cases	Lb.	.34—.35
Sodium Nitrate, refined	100 Lbs.	7.00—8.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.00—5.50
Sodium Benzoate	Lb.	1.15—1.25
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bicromate, bbls.	Lb.	.18—.19
Sodium Nitrite	Lb.	.15—.16
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	2.50—2.75
Sulphur, roll	100 Lbs.	4.00—4.25
Sulphuric Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphite, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.90—1.00
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	—10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.....
Cobalt, metal	Lb	—2.50
Cobalt Oxide, grey	Lb.	—1.65
Copper, casting	Lb.	—.17
Copper, electrolytic	Lb.	—.18
Copper, electrolytic, in car lots	Lb.	.18
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.06⅞
Lead, in car lots	Lb.	.06
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.05
Spelter	Lb.	.09—.09½
Spelter, in car lots	Lb.	.07¼
Steel, mild	100 Lbs.	—5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 guage	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.32
Motor Gasline (service stations)	Gal.	—.35
Lighting Gasoline	Gal.	—.37
Naphtha	Gal.	—.31
Coal Oil	Gal.	—.19½
Fuel Oil	Gal.	—7.00
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	24 to 28c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 30c	per gallon
Dip Oil, 20 per cent.	38 to 46c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Flake	.08½ to .09½c	per pound
Naphthalin Balls	10½ to 11½c	per pound
Alpha-Naphthylamin	45 to 50c	per pound

Flotation Oils and Naval Stores

Spirits of Turpentine, in bbl. lots (Imperial), gal.		1.55—1.60
Rosin, Grade G, in 280 bbl. lots		20.00
Rosin, Grade W.W., in 280 bbl lots		22.00

Vegetable Oils

Linseed Oil, raw, in bbl. lots, (Imperial), gal.		2.30—2.35
Linseed Oil, boiled, in bbl. lots (Imperial), gal.		2.33—2.36

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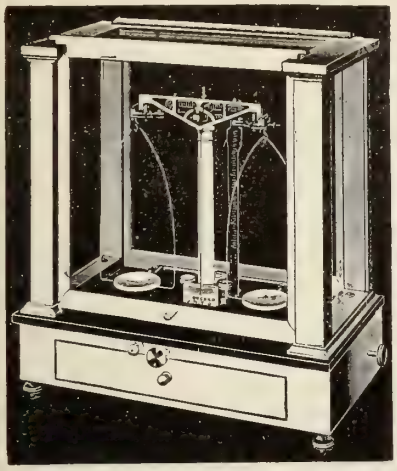

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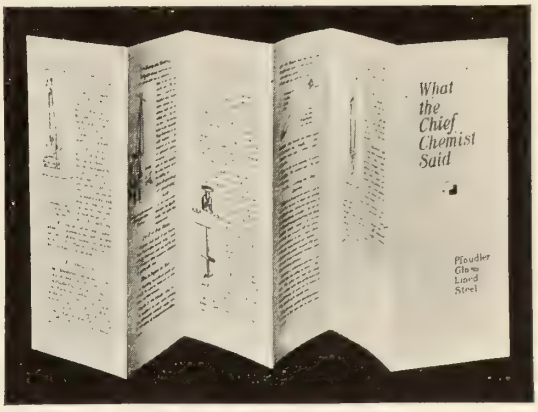

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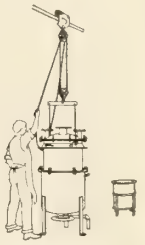
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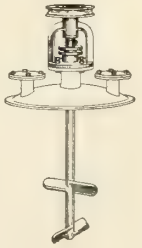
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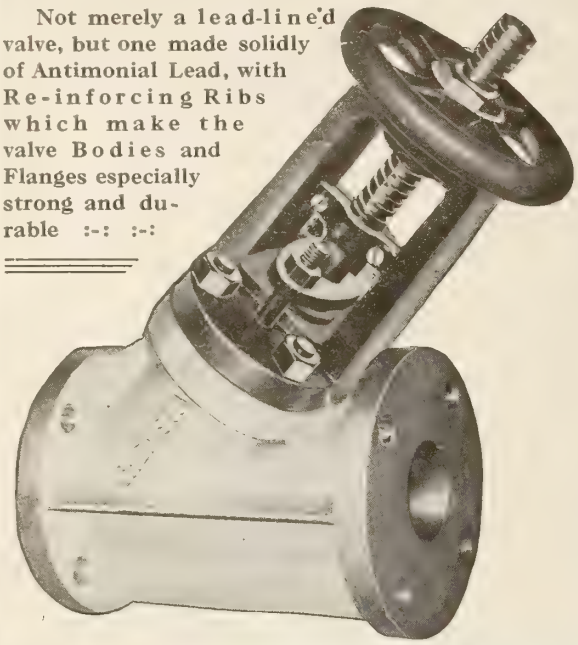

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Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically every mineral with the exception of coal and tin is found in he premier mineral province of Canada. Preliminary figures of output as compiled by the Ontario Bureau of Mines show a valuation of $80,165,720. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:—

Silver	$184,976,626	Nickel	$138,010,436
Pig Iron	78,920,722	Gold	50,864,925
Copper	49,947,080	Cobalt	5,916,834

Non-metallic products include actinolite, arsenic, barite, cement, clay and shale for ceramic industries, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, lime, mica, mineral waters, natural gas, petroleum, quartz, salt, sand and gravel, stone for all purposes, and talc.

Industrial Opportunities: Midway between West an' East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities both by rail and water are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Hydro-electric power both potential and developed is available. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula.

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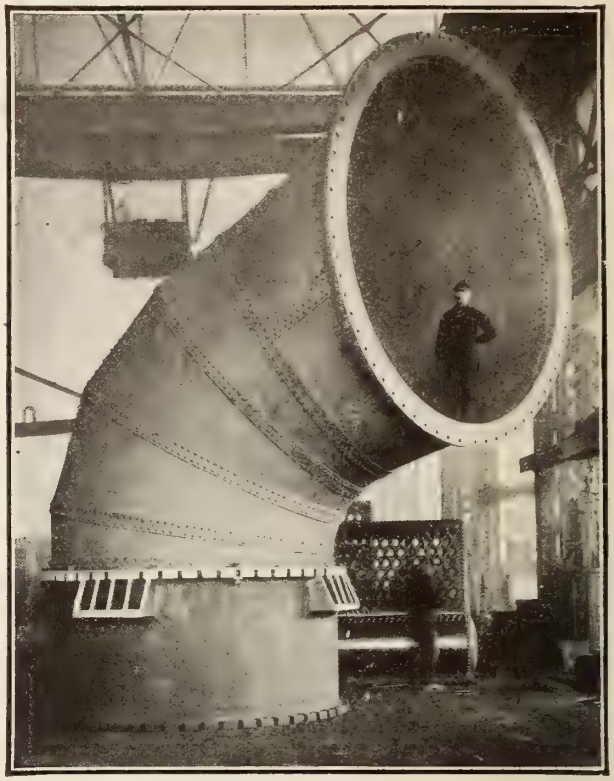

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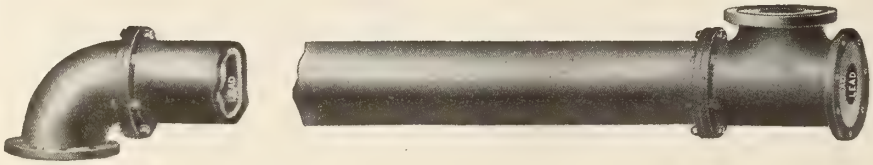

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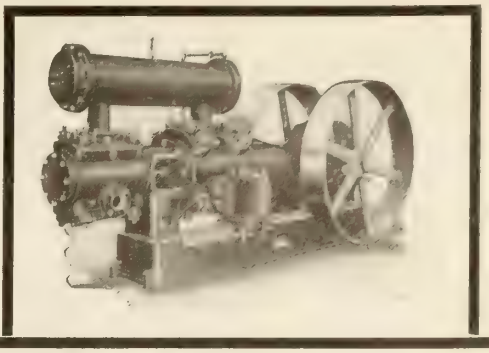

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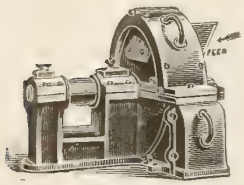

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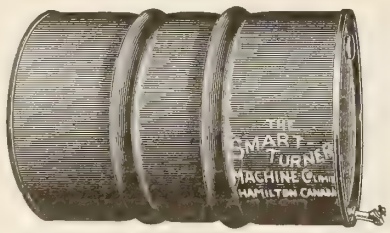

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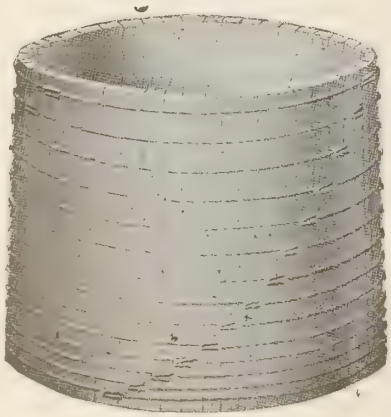

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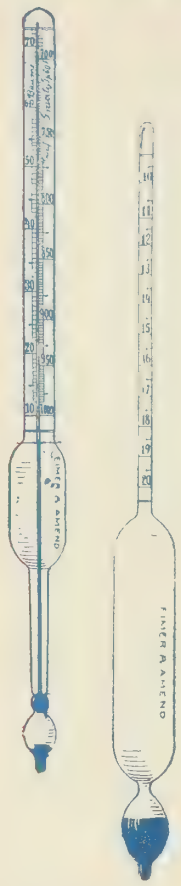

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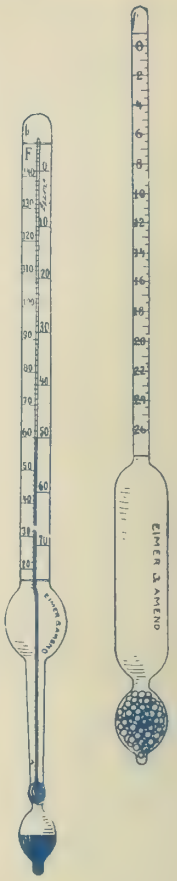

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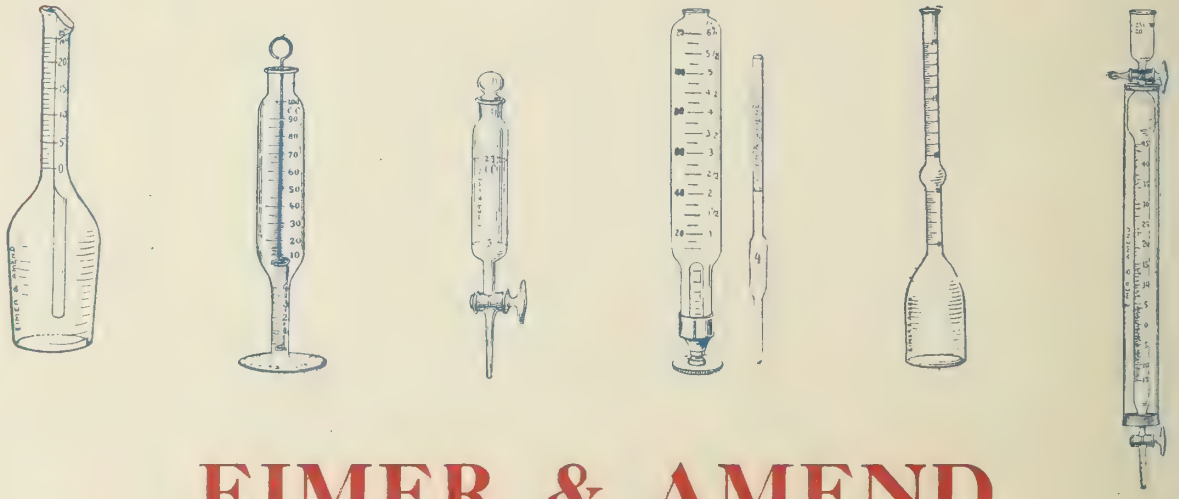

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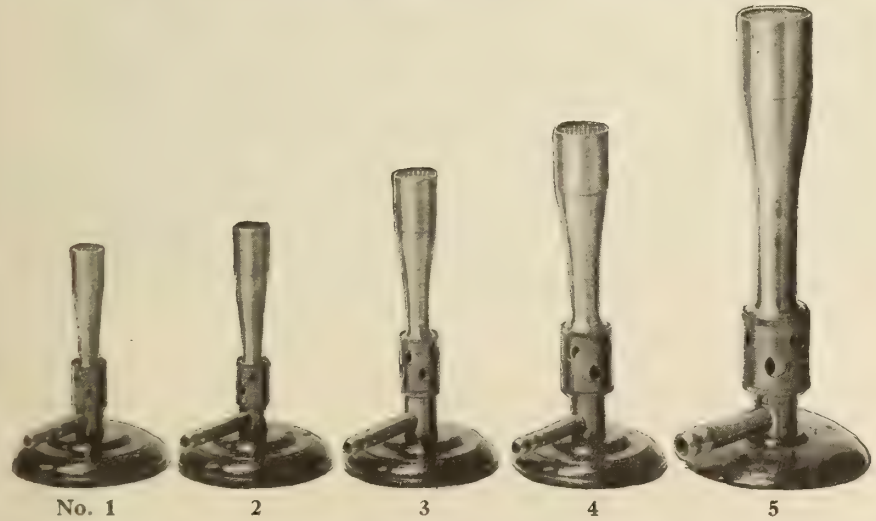

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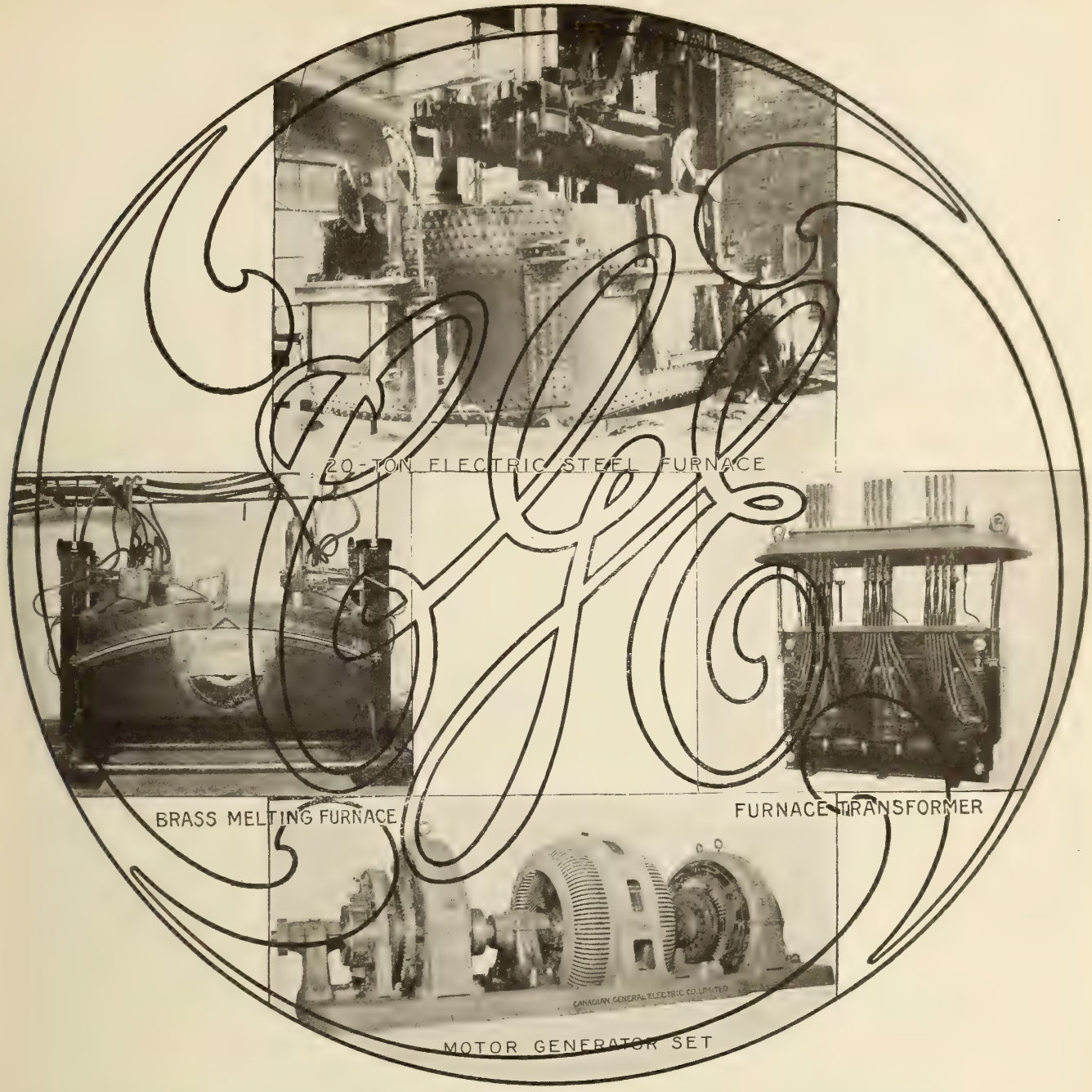

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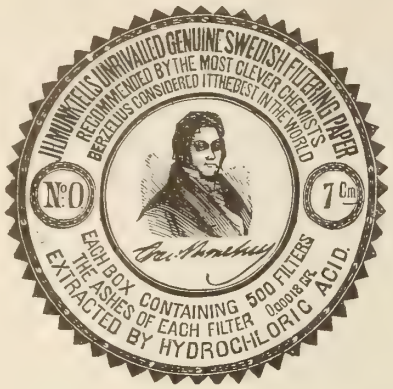
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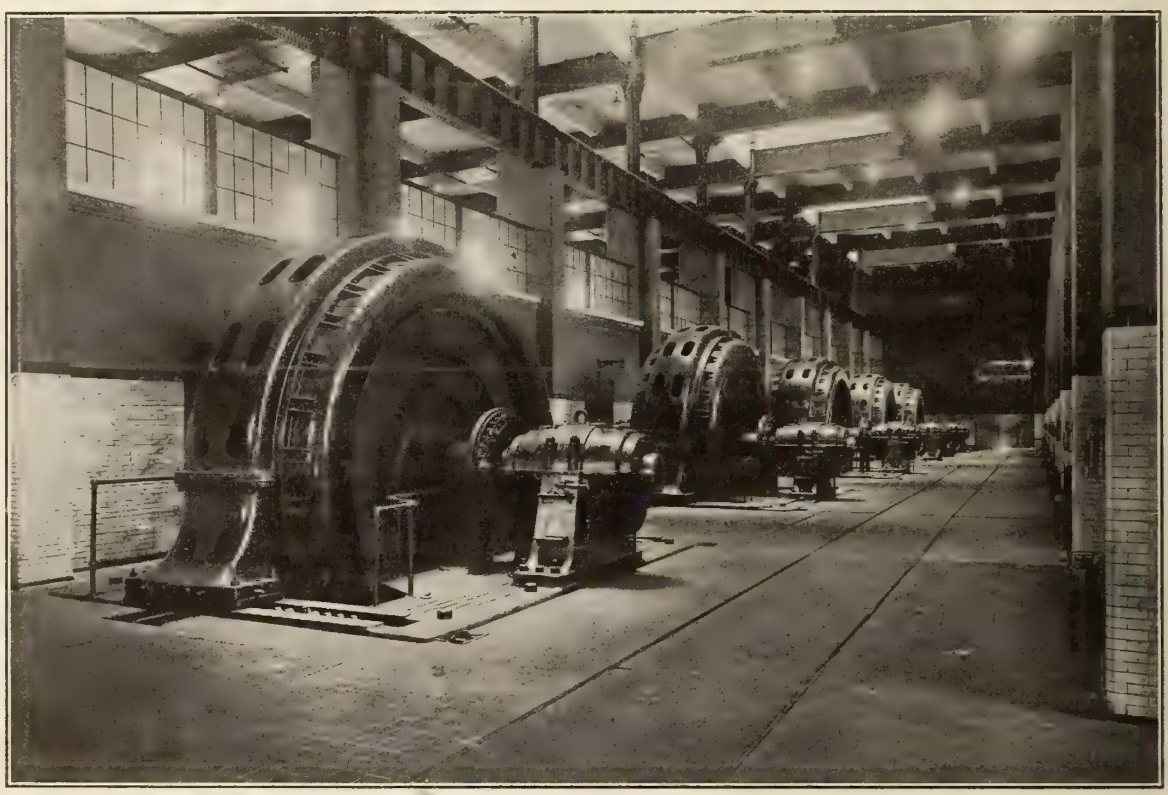

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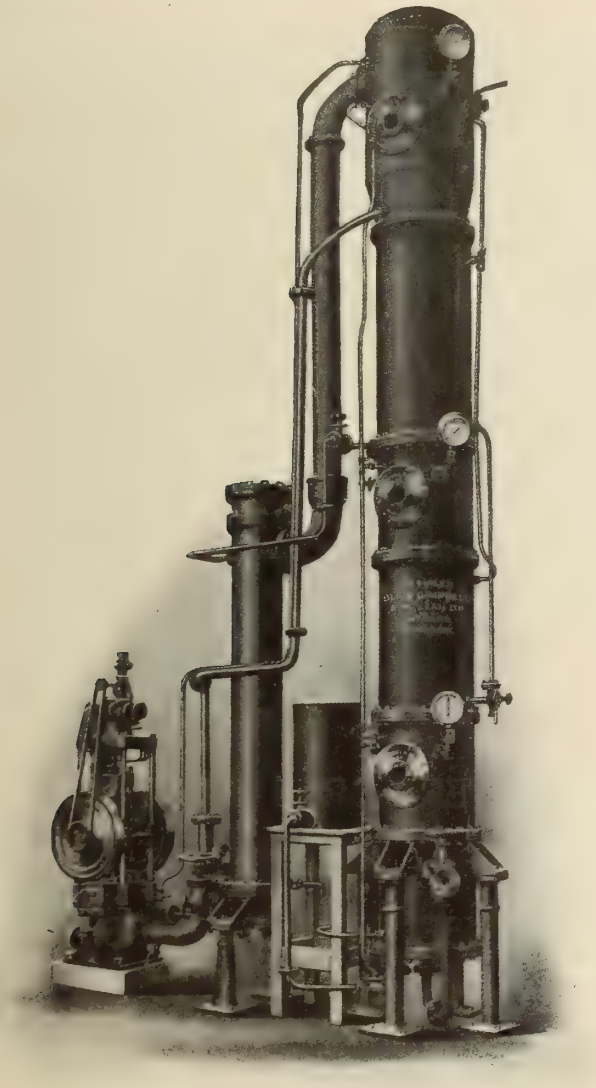

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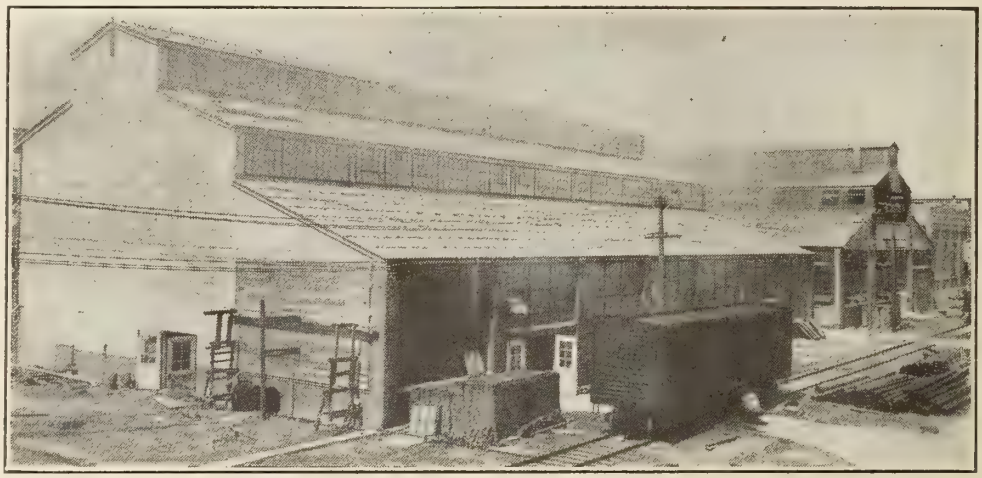

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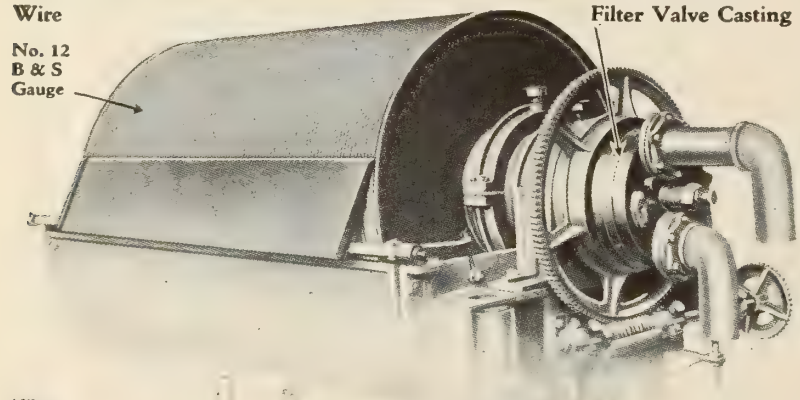

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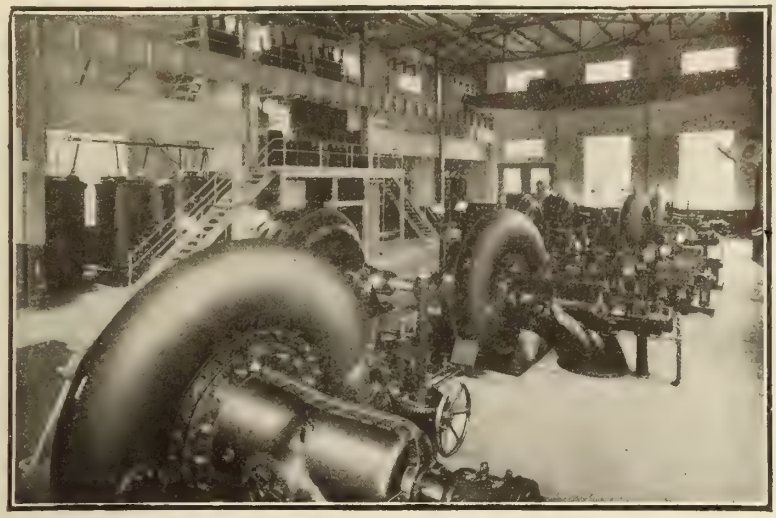
Hydro Electric Power Plants



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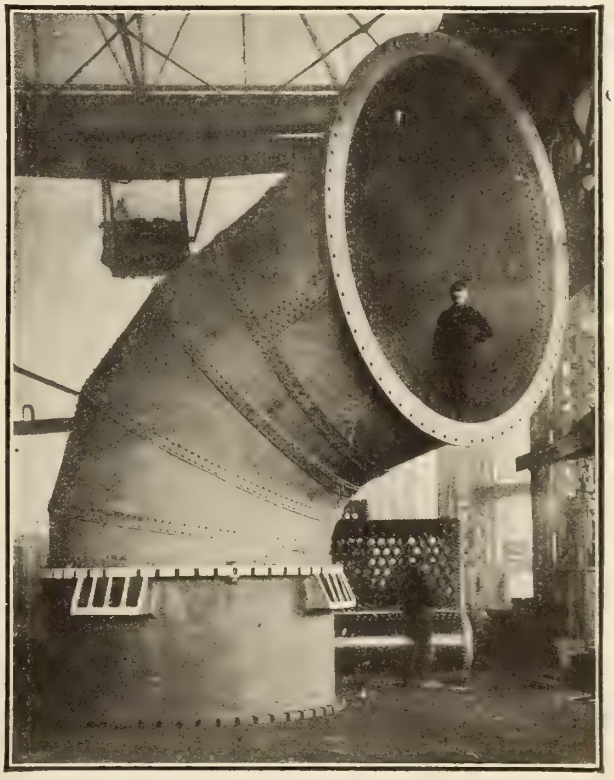

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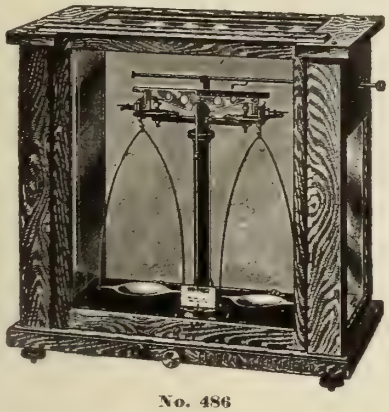

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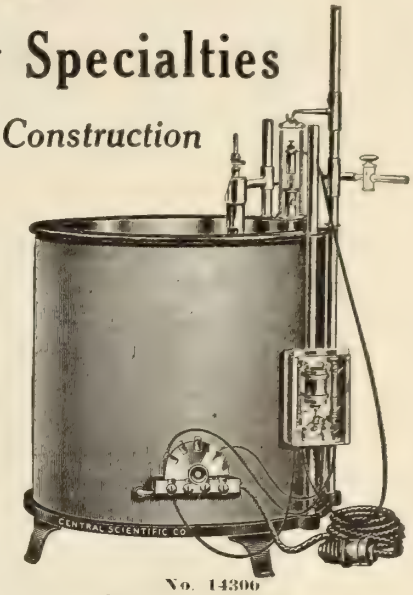

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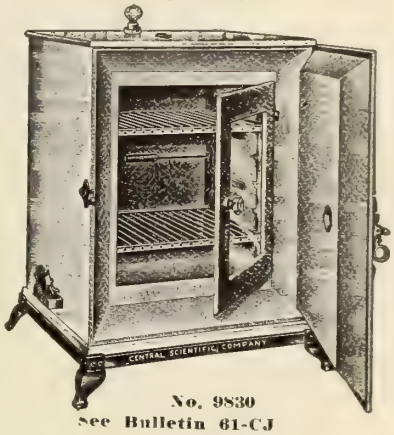

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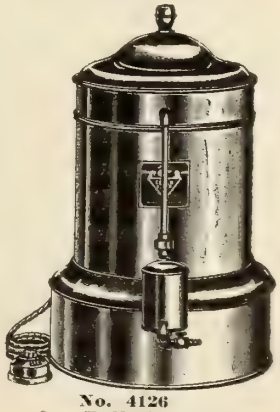

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Vol. 3 TORONTO, AUGUST, 1919 No. 8

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EDITORIALS

SHAWINIGAN.

THE romance of modern science grows in beauty as it becomes more and more complex. The development of Canada has surprised even Canadians, and it is little wonder that others fail to understand how some things have become possible. Every country and all peoples speak of their war efforts according to their national temperaments. It is only by comparison and after considering the total population, the status of industry, and the extent of the country that a true measure of the real individual push that was put up in Canada can be understood.

Speakers and newspapers have rightly dwelt upon the contributions made in men and money to the visible fighting strength displayed abroad. It would be well, indeed, particularly at this time, if more analytical attention could be given to a study of those industries which supported these efforts. Some are well known, but others still remain hidden from public attention for the reason that the connection is not obvious and we have a limited number of people into whose minds such conceptions are likely to come.

While the manufacture of shells and explosives were enormous industries in Canada for over three years, and while every compliment must be paid to all Canadian chemists and technical men who had any part in the war program, we wish particularly to review at this time the work that has been developing at Shawinigan Falls, Quebec, and which came to such timely fruition during the last four years.

The relationships of industrial chemical processes to success or failure in war were brought out most striking and for the moment one heard inquiring remarks from those engaged in professions far afield from chemistry. The struggles of American chemical industries both to free themselves from foreign bondage and to establish plants for gas warfare and nitrogen fixation purposes are, generally speaking, well known. It is, therefore, but proper to pay some attention to projects less known by the world in general and of greater interest from the Canadian viewpoint.

There is always something very interesting about the new. Older industries may plunge along in their strudy race, but when a new path for human energy is observed interest and speculation is at once aroused.

Both Shawinigan Falls and the industries located there are relatively new. It is strange, indeed, to think that in a town close to the northern boundary of population in Quebec and beyond which an undeveloped region stretches clear to the Pole, new industries should spring up during a war, which in themselves represent the very essence of man's control over matter, and which are of such great permanent value to Canada.

There is but one reason for Shawinigan—cheap electric power in quantity. The waters of the St. Maurice competing with the most ancient and hardest of igneous rocks had not yet gained their battle and the result was a remarkable series of water falls, which were the delight of the Indian and the hunter until a short generation ago. They are now in harness.

In this issue we dwell upon these achievements in a series of technical articles. We may, then, be allowed here to speculate on their general significance. If there is one thing more than another which impresses a traveller who has really seen Canada by canoe it is the amazing possibilities for the development of hydro-electric power. The St. Lawrence River is but a type. Everywhere throughout this north country streams may be found where nature has already done practically everything but build a transmission line for man. Certain chemical industries thrive only on abundant cheap electric power. For these, Canada is the American location, because from here, whether they chose the Pacific or the Atlantic, they can command large markets. Shawinigan has been put where it is in the chemical and metallurgical field because of this faith on the part of those interested financially, but there is no reason why other inland points may not do equally well.

The Shawinigan Water & Power Co. began with general power developments in mind, and when called upon, branched out into chemical fields with much less than the average surety of success or financial returns. The parts played by individuals in the production of acetic acid, acetone, magnesium and other chemical and metallurgical products on a large scale, form a connected series of stories where ordinary men have risen to extraordinary occasions.

If the spirit which won there can permanently take hold of research work in Canada, there is assured an era of development in all our industries which in time must very favorably alter our trade balances. The association of industries now located at this point is typical of what can be done when men think and work together. It must be noted that the town has a source of most satisfactory labor in the French-Canadian population of the district. A cotton mill was established, principally with the stability

of labor in mind. The chief companies there have very seriously taken up home planning and housing schemes and technical education is receiving every attention. Electric power is the binding link but there are few cases, if any, where companies engaged in such a wide diversity of problems in both organic and inorganic chemistry, are united in their laboratory research work. The foundations now being laid for research work in industrial chemistry are so broad that it is impossible to predict where they may lead or what the finished research establishments may involve.

The growth of electro-chemical industries in Canada is most certain and chemical processes may be established or duplicated in other provinces, but there will always remain a distinct connection between the source of some very important chemical and metallurgical products and that fine old Indian name, "Shawinigan."

PARLIAMENTARY INTEREST IN RESEARCH.

"THAT in the opinion of this House, it is desirable that a special committee be appointed forthwith to consider the matter of the development in Canada of scientific research, with power to call for persons, papers and records, to examine witnesses under oath, and to report from time to time." So ran the order of reference from the Parliament to one of its special committees appointed last session. Under the chairmanship of Hume Cronyn, K.C., of London, the committee met a number of times, and at each meeting a scientist of note was present to address the members and to assist in educating them to our scientific needs as the speaker saw them. Among those who appeared were:—

Dr. A. B. Macallum, Administrative Head of the Research Council; Dr. R. F. Ruttan, Professor of Chemistry, McGill University; Dr. A. S. Mackenzie, President of Dalhousie University; Dr. J. C. McLennan, Professor of Physics, University of Toronto; Dr. R. D. MacLaurin, Professor of Chemistry, University of Saskatchewan; Prof. Clark, Department of Physics, Queen's University; Prof. Dayton Miller, Case School of Applied Science, Cleveland; Prof. J. C. Fields, University of Toronto; Prof. W. Lash Miller, Department of Chemistry, University of Toronto; Dr. W. A. Hamor, Mellon Institute, Pittsburgh, U.S.A.; Dr. S. W. Stratton, Bureau of Standards, Washingon, D.C., U.S.A.

The meetings of the committee were not as well attended as they deserved to be, but certain of the members took considerable interest in the proceedings, and undoubtdly much good seed was sown.

The chairman presented a report to the House on July 2nd, which expressed the unanimous belief of the committee that federal aid to research should be forthcoming, and recommended that a bureau of standards, similar to that at Washington, be established in Canada. No conclusion was reached by the committee as to the best method of affording this necessary support, but the reappointment next session of a similar committee to carry on the study thus commenced was urged in order that a definite decision may be reached.

Mr. Cronyn presented the findings of his committee in a masterly address in which he made an appeal to the members "to turn their trained minds upon the question, to read the evidence regarding it, and to reach a decision uncolored by political or sectional prejudices." In conclusion, he said: "If the testimony of one individual can be of any value, I wish to put myself on record as being convinced of the vital part which scientific research plays in modern civilization. No country can hope to make full use of its opportunities unless the aid of science is invoked to the fullest extent. In Canada, more than in older and fully occupied countries, this need is imperative. We would discover how vast are our resources if we could but turn the searchlight of science upon our far-flung Dominion.

"I am, sir, as I have pointed out before, an enthusiastic believer in the future of our country, and my prayer, therefore, is that not only may our outlook be broad and sane, but that we may possess the courage and pre-vision boldly to adopt any measure which will add to the national well-being."

It must be realized that before enthusiasm in the matter of national research is obtained an enormous amount of work must be done educating not only members of Parliament, but also large groups of business men to the point where they see a real connection between research and the industrial progress of Canada.

TRADE CONDITION REPORTS.

IT is well at times to consider an analysis of yourself made by some one who, while friendly, is not likely to make any unwarranted statement, and who considers everything in world-wide proportion.

The report on the Trade of Canada for 1918, as prepared by Mr. F. W. Field, British Trade Commissioner at Toronto, is really a personal letter in effect. It is addressed primarily to business men in the United Kingdom, but it is of value for manufacturers here and elsewhere. In a general way, it is a message filled with unbounded faith in the magnitude of the future developments along all lines in Canada.

Some very reasonable statements are made in connection with the problem of obtaining business here. The methods of manufacturers in England who have attempted to do business in Canada have not been devoid of serious mistakes. In general, conditions here have not been studied personally by qualified men from the home offices. Canada is not China or South America, and there is the ever-present competition from the United States.

Considerable space in the report is devoted to sug-

gestions for exporters into Canada, and more particularly Ontario. It is stated that British trade has suffered by the appointment of unsuitable local representatives. British firms are criticized for the amount of restraint they impose on their representatives and the inadequate allowances supplied. In some instances, British firms, having offices in New York, would be better served if Canadian business was handled directly through a Canadian office. In the general question of advertising, British manufacturers do not keep pace with either American or Canadian manufacturers, and while consistent advertising maintains its high value as an investment in America, British firms are certain to be handicapped.

One thing in particular has an influence which we believe may well be stressed. Canadian engineers amplify their experience in the United States and there is reciprocity in technical education and training. Until United Kingdom works absorb more Canadian engineers with the definite policy of returning them to Canada and America, our engineers will not appreciate European standards and methods, with the net result that there will always be this brake to trade.

For those desiring a general knowledge of recent Canadian trade statistics, the report is most excellent, and it is more than likely that many of the irritations to trade will be avoided in future.

ALCOHOL AND INDUSTRY.

THIS is a subject which we cannot help but feel should be kept continually before chemists and manufacturers, in order that ultimately the Dominion Government may be led to establish legislation which will be reasonable and suitable to Canadian needs. Foreign chemists and manufacturers fail utterly to understand the Canadian situation in this respect and rightfully wonder if we have any one in authority here who has any grasp whatever of facts relating to basic industries.

The full story of the efforts made so recently by the Honorary Advisory Council for Scientific and Industrial Research is one which should be known to every one. Much damage to the success of new legislation was caused by those who were not engaged in making products from alcohol, which could well be classified with those of greatest importance; and the Government was not prepared to accept a small present loss in revenue in order that industrial users might have a chance to compete with foreign manufacturers and build up very essential industries within the country. The question of special denaturants was very thoroughly worked out upon most modern lines and provision made for the proper sale of pure ethyl alcohol. When all the foolish things connected with the Inland Revenue Act are taken into consideration, it is indeed remarkable that alcohol for industrial purposes is made in Canada at all. If it is possible to tax industries out of existence it would seem that the Dominion Government was lending itself to this process in this instance.

The net result has been that those companies engaged in manufacturing alcohol for industrial purposes are investigating and depending upon foreign markets and therefore the report of the committee of the British Government with the late Sir Boverton Redwood as chairman, is of special importance, and should go far to set at rest any real or imaginary doubt remaining in the minds of Cabinet ministers or Ottawa officials in reference to what should be done here.

In England, the words "power alcohol" have been coined to designate alcohol for combustion engines and industrial purposes. It is just possible that the lack of action in the United Kingdom in casting off the antique restraints on the alcohol industry has had its reflection in Ottawa, as our Inland Revenue laws were based largely on English practice in the first instance. The full report of the Inter-Departmental Committee on the Production and Utilization of Alcohol for Power and Traction Purposes should be thoroughly digested by those interested here, and an early effort made to again bring forward legislation involving such radical changes in the Inland Revenue Act as will allow for the development of industries in Canada depending on alcohol and acetic acid, and in the end give us a strong position in the world's markets for products which we are in such a favorable position to produce.

A CHANGE IN MANAGEMENT.

WITH this issue it will be observed that the Canadian Chemical Journal has undergone certain changes in management. E. B. Biggar, whose whole life as a publisher has been spent in developing the interests of several branches of Canadian industry, withdraws, and L. E. Westman, who has devoted all his energies to the chemists of Canada and the general business of expanding this Journal during the past year, is accepting the responsibility of carrying forward this work.

The story of the growth of this Journal during the past three years runs parallel to the growth of a new interest in Industrial Chemistry and an expansion of business in the Dominion. The originators of the Journal displayed a faith in this development and it may now be announced that chemists and business men have found this Canadian publication of considerable value as a medium for expression and an aid to trade.

It is the aim of the management to put forward a pleasing publication, which Canadian chemists will desire to look upon as their contribution to the world's league of scientific and business journals.

Power Developments on the St. Maurice River

The History of the Development of the Water Falls of the St. Maurice River Centered at Shawinigan Falls, Showing Their Relation to Possible Future Industrial Progress

By F. T. KAELIN*

ANYONE who some twenty years ago reached the then far-away falls of Shawinigan, could have joined the poet in saying:—

"I hear the tread of pioneers,
Of a city yet to be,
The first low hum of waves, where soon
Shall roll the human sea."

Up to that time the grandeur of that timbered wilderness known as the St. Maurice Valley, with its fine rivers and falls of unique beauty, had only been disturbed by the echo from the axe of the lumberman, and the occasional gun-shot from the game-hunter, and lover of natural beauties.

Of this little-known region, the Shawinigan Falls were the prettiest and best known, being situated approximately twenty-two miles north of the mouth of the St. Maurice River. These consist of a series of cascades divided by an island as they flow from the quiet river above, uniting half-way down their course into a mighty rushing stream, then falling into the whirlpool in the gorge below, to ultimately emerge from between majestic and rocky cliffs into a wide bay.

It is only natural that such a spot should have attracted among its admirers, men who, besides appreciating its scenic beauties, possessed the farsightedness necessary to have seen the possibilities of applying the great force of nature to the benefit of mankind, and had the necessary courage to push through to a successful end, financial and industrial undertakings with all the risks involved in works of such magnitude.

To-day, one lives in an age which is a turning point in the world's history. This is caused partly by the Great War which has just come to an end, and perhaps even more by the extraordinary strides and progress made in recent years, in applying the material forces of the universe to the use of mankind.

In whatever way matter is transformed and used, the paramount basis of it all is "power," and upon the two words "mechanical power," pivots the progress and welfare of the world.

There is no doubt to-day, that the country which possesses and develops the cheapest mechanical power, has the advantage over other countries in a material sense, and must attain first rank as regards the production and commerce of the world, as other natural resources without mechanical power behind them, can never be developed to their full usefulness.

The two main sources of power are coal and falling water.

Where conditions are favorable, power derived from the use of coal will for a long time supply the greater part of our requirements, but the cost of its production is steadily mounting, and every horse-power developed helps to deplete the available coal reserve.

The other main source of power—water-falls—is destined by its inexhaustible life to form the basis upon which future progress and prosperity must be built.

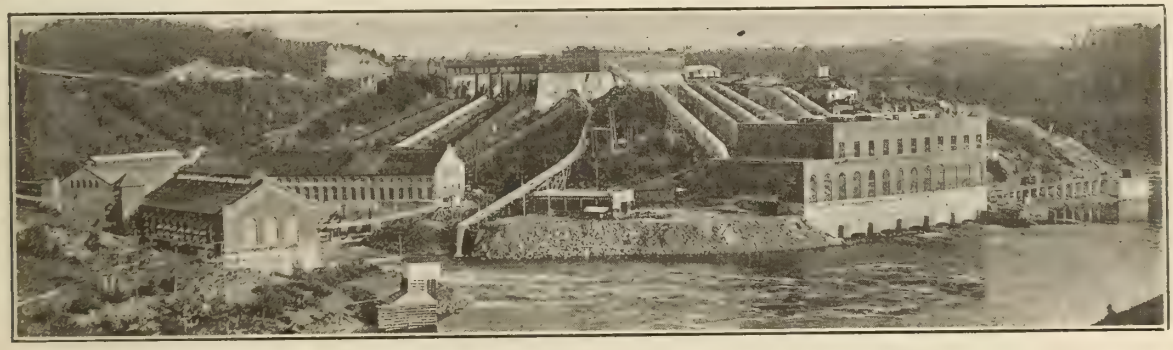
It is obvious that when both these sources of power supply are available, the most economical in respect to cost of production and utilization will have precedence, and right here it is pertinent to add that to this problem of a selection of source of power must be applied sound judgment, for the proper solution is not to be found in the adoption of either form of development, except as determined by cost of plant and cost of operation. Generally speaking, steam plants involve a lower capital expenditure and a higher operating cost. It is, therefore, necessary that the water-power plant be built at a low enough cost to conserve for it the advantage of low cost operation. In other words, if the cost of a water-power plant is such that the fixed charge on its capital expenditure plus operating expenses, amount to the cost of the steam power, the development of the water-power is not justified. It is for this very reason that many water-power developments have *not* been a financial success.

The Shawinigan Water & Power Co. is in the happy position of owning such water-powers with indisputable rights on the St. Maurice River at Shawinigan Falls and the Gres Falls, and, further, controls the power from the development at Grand'Mere, owned by the Laurentide Power Company.

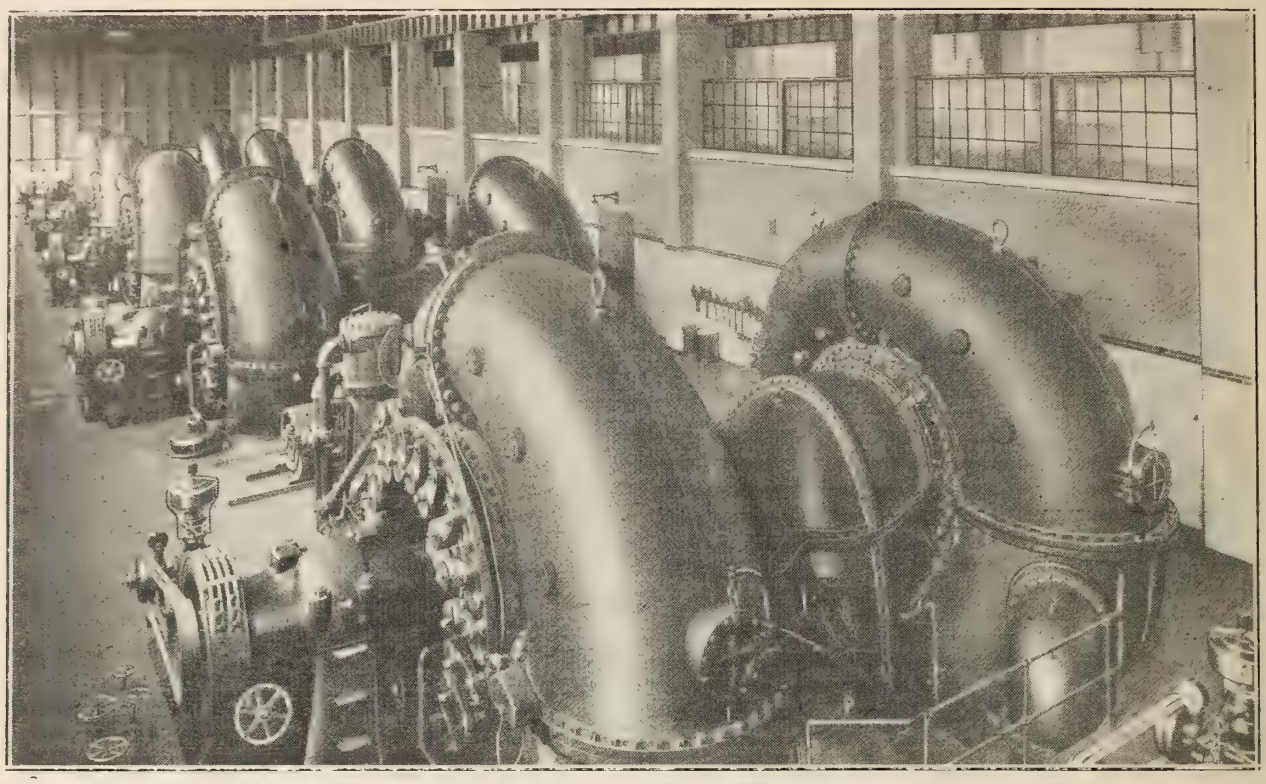
At present the combined generating capacity of this development is 330,000 h.p., with the flow of the St. Maurice River regulated by the great storage basin at La Loutre Dam, the generating capacity of these two plants will be about 480,000 h.p., and a further development at Gres Falls will raise this to over 600,000 h.p.

These three power plants, located within 18 miles of each

* Chief Engineer, Shawinigan Water & Power Co.



General View of Shawinigan Water and Power Company's Plant at Shawinigan Falls, Que.



Turbines of Power House No. 2 of Shawinigan Water & Power Co.

other on the St. Maurice River, controlled and operated by one company, form a very strong power centre.

Shawinigan Falls, 150 feet high, and capable of developing 250,000 h.p., was the starting point for the hydro-electric power developments of the Shawinigan Company in the St. Maurice district.

These falls, due to their peculiar formation, furnish a most remarkable natural water-power development, and thus the pioneers of Shawinigan were able to produce a power plant which, because of the low price at which it could profitably sell power, was destined to successfully compete in the power markets of the world.

The Shawinigan Company has acquired from the Quebec Government, and now owns, some 1,100 acres of real estate surrounding Shawinigan Falls, carrying with it the ownership and control of the water-power there existing.

The power development at Shawinigan Falls has taken place within the last twenty years, starting in 1901 by furnishing hydraulic power to two local industries, the Northern Aluminum Company and the Belgo Canadian Pulp and Paper Company.

The first electric installations made in 1902 consisted of two 5,000-h.p. water-wheels and generators. Step by step the plant was enlarged to utilize the capacity of the hydraulic works, until in 1910 the installation of No. 1 station reached the amount of 58,500 h.p.

Owing to the demand for power, the year 1910 saw the company reaching a point where the maximum output of No. 1 installation was utilized. It was deemed wise not to attempt to increase the capacity of the first power-house, but to augment the available supply of hydro-electric power by the carrying out of an entirely new development which would express the latest ideas in construction and operation.

Plans were made for a separate and distinct power plant, which, however, would generate 60-cycle power as this was deemed the more satisfactory for the fulfillment of the new power contracts of the company.

The original power development No. 1, included the canal, 100 ft. wide, a bulkhead with six penstocks, and the No. 1 power-house.

The second epoch in power development was marked by the erection of the new power-house, 100,000 h.p. output, and the new high-tension 100,000-volt transmission line to Montreal.

The No. 2 development uses the canal, which was enlarged at the end to form a larger forebay, and a new bulkhead constructed at an angle of about thirty degrees with the old bulkhead adjoining it. The bulkhead is built entirely of reinforced concrete and steel and provision was made for five main penstocks and one four-foot penstock for the turbine-driven exciters. The width of the bulkhead at the bottom is sixty feet; the height from the rock to the operating floor is 40 feet, and the length of the structure 225 feet.

The power-house is built entirely of reinforced concrete, brick and steel. The walls inside are faced with pressed buff brick, and up from the floor, about ten feet, with glazed, enameled brick. The floor is tiled with English red quarry tiles, and conform with the general interior finish of the power house. The width of the building is 115 feet, its length 300 feet, and the height from the bottom of the foundation to the roof is 112 feet.

There are now installed five direct connected generating units, each complete with its double runner, horizontal turbine, developing 20,000 h.p. at the normal operating head of 150 feet, and a speed of 225 r.p.m.

Each generator is mounted on a continuation of the main shaft of the double runner 20,000-h.p. turbine and operates at the same speed—225 r.p.m.

All 60-cycle generators feed a parallel system of 6,600-volt bus-bars, which allows the connection of any generator to

any transformer bank, and thus gives an exceedingly flexible arrangement for the transmission of power.

All transformers are oil-insulated and cooled by water. It is interesting to note that the efficiency of these transformers is approximately 99.3 per cent.

All of the oil circuit-breakers or switches throughout the station are operated electrically by means of small control switches on the switchboard control bench, from which not only the generation of power is controlled but also the transmission of power.

The oil switches in the station are so connected that by means of manually operated disconnecting switches they may be isolated for repair work without interrupting the supply of power and without danger to the operators. All of the switches are enclosed in fireproof cells of concrete or in fireproof rooms, so that in case of explosion or other injury to the circuit-breaker the damage would be confined to the switch itself and would not spread to other parts of the generator station.

The pressure of the electricity generated in the power house is controlled by means of automatic regulators, so that at the will of the operator the pressure may be maintained constant or at any varying value, either at the power house or at any point on the transmission system. This allows the operator to centre his attention on the proper operation of the machines themselves, and as all of the operations with respect to starting, stopping and putting into service of the turbines and generators are controlled from the switchboard, the whole plant runs as smoothly as a watch.

Shawinigan Station No. 2 is operated at a very high over-all efficiency, about 85 per cent. of the total power it is possible to obtain from the water being sent out from the generating station as high-tension power, ready for transmission.

The full capacity of this new station was absorbed within about four years after it was built, and arrangements were made with the Laurentide Power Company at Grand' Mere to take over all their surplus power.

The Grand' Mere Falls were harnessed a great many years ago to supply power to a small pulp mill, which later, owned by the Laurentide Company, expanded into the manufacture of paper, and gradually grew to be an industry of very large proportions. In 1913 this company, owning the falls, decided to develop them to their fullest extent, and completed in 1915 a power development and dam, whereby the falls were raised to a height of 85 feet, which makes it possible to obtain at this point about 60 per cent. of the power that can be developed at Shawinigan Falls.

It had been long felt that the flow conditions of the St. Maurice River, and therefore the supply of power, should be augmented and improved, and if there had been any means of storing water during the time of high floods, and using it during the low-water periods. With this point in view, the great La Loutre Dam was built by the Quebec Government.

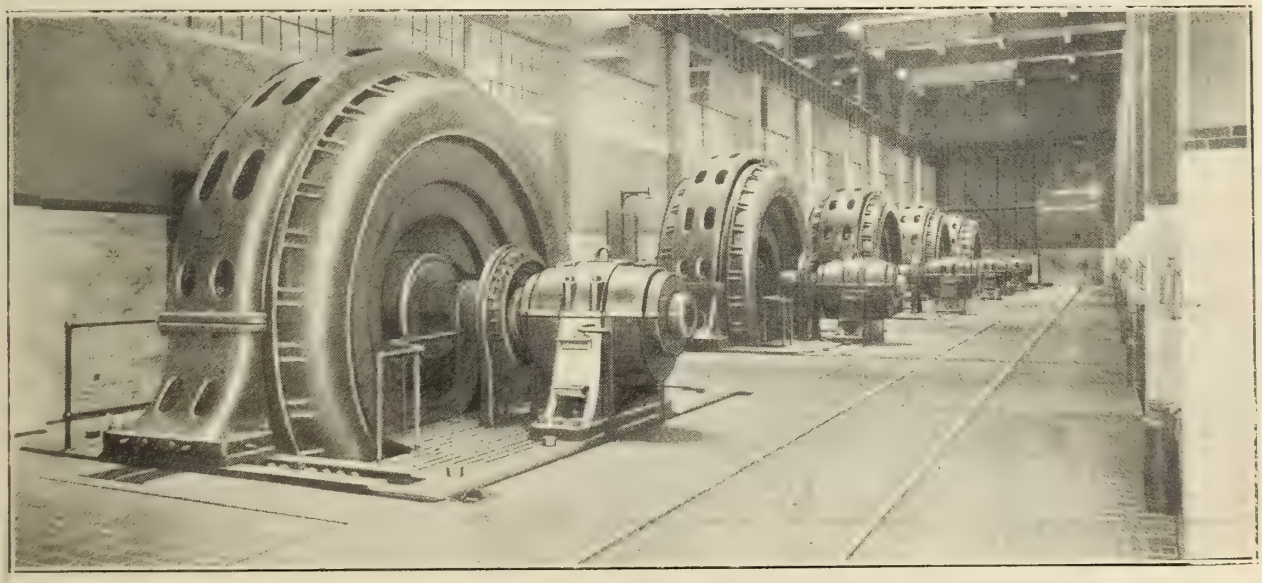
This dam at the head waters of the St. Maurice River, nearly two hundred miles north of Shawinigan Falls, is 1,800 feet long, 70 feet high, and forms a lake 360 square miles in area impounding many times as much water as the great Assouan Dam in Egypt. When full, this reservoir contains enough water to generate one billion kilowatt hours in the power plants at Grand' Mere, Shawinigan Falls and Gres Falls, which amount of electricity is practically equivalent to the gross output of the Shawinigan Company in the year 1915. It will thus be seen that a very large addition to the power which can be developed at the low-water stages of the river, is obtained by means of this dam.

Three regulating dams have also been constructed on the Manouan River, a large tributary of the St. Maurice. This tributary enters the main river about 120 miles above Shawinigan Falls.

These dams impound about 600 square mile feet of water, which is sufficient to generate 90 million kilowatt hours when utilized in the power plants of the company at Shawinigan Falls, Grand' Mere and Gres Falls.

The power conditions are greatly improved by the local storages at Grand' Mere and Shawinigan Falls.

The Grand' Mere dam forms a lake about 20 miles long, and impounds about 35 square mile feet available for power purposes, which is sufficient to generate five million kilowatt hours in the power plants of the company. The natural lake above Shawinigan Falls has been increased in size by the gates and dams of the Shawinigan Company, and there now exists a lake about four miles long, impounding about nine square mile feet available for power pur-



Generators in Power House No. 2, Shawinigan Water & Power Co.

poses, which is sufficient to generate about 1,000,000 kw. hrs. in the power plants at Shawinigan and Gres Falls.

The company also owns the Gres Falls, an undeveloped water-power about six miles down the river from Shawinigan. This, together with the surrounding property and water-rights connected therewith, form a valuable source of power for the future.

These falls, with a drop of 50 feet, are capable of developing about 33 per cent. of the power generated at Shawinigan.

The use of hydraulic power for the generation of electricity is the one way by which hydraulic power can be transmitted great distances. In those cases where mechanical power is required for manufacturing purposes or for the production of special kinds of electricity, this power can be utilized at the site of the waterfall, making it unnecessary to generate electric power, but the water may be used directly in the industrial plant for the production of the required mechanical power.

In this way the Shawinigan Company sells hydraulic power or water-power under pressure to the Northern Aluminum Company and the Belgo Canadian Pulp and Paper Company, for the production of aluminum and pulp and paper products respectively.

Summary of Power Developments.

Summarizing the installed capacity in electric generating equipment owned or controlled by the Shawinigan Company:

Shawinigan Plant No. 1	58,500 h.p.
Shawinigan Plant No. 2	100,000 h.p.
Laurentide (120,000 h.p. installed)	82,500 h.p.
St. Narcisse	1,200 h.p.
Steam Plant of Quebec City, Public Serv. Corp.	4,000 h.p.
Total electric capacity	246,200 h.p

THE EXECUTIVE OF SHAWINIGAN WATER & POWER CO.

Total Development, Present and Future.

Summarizing the power situation, we find:

Electrical equipment now installed	246,000 h.p
Hydraulic power supplied	50,000 h.p
Power used by Laurentide Co.	37,500 h.p
Future provision at Laurentide	60,000 h.p.
Future additional development at Shawinigan	100,000 h.p.
Future development at Gres Falls	150,000 h.p.
Giving a total of	643,700 h.p.

of which 333,700 horse-power is now installed as hydraulic or electric power, leaving 310,000 horse-power for future development.

The Shawinigan Company's policy has been not only to sell power, but also to gradually develop along industrial fields, and make use of their own electric power by expanding the existing plants, and creating new industries. Having at its command a considerable amount of readily available power, and already producing in one of its subsidiary companies, the Canada Carbide Company, carbide, the nucleus of many chemical industries, the Shawinigan Company developed during the past years, such new undertakings as the Canadian Electro Products Company, the Shawinigan Electro Metals Company, and the Canadian Electrode Company.

These industries were soon followed by several private concerns, such as the Canadian Aloxite Company and the Canadian Ferro-Alloys Company, which produces corborundum, alloxite and ferro-silicon, respectively.

Shawinigan Falls, already the largest electro-chemical centre in Canada, has every prospect of growing beyond our present imagination, having the great advantage of still having hundreds of thousands of horse-power of electrical energy waiting to be developed.

By the present connection of power circuits, and the future additions of more power from the north, the high-power trunk lines which will be fed from the different power plants will form a tremendous power bus-bar, connecting the three towns in the St. Maurice Valley, i.e., Grand' Mere, Shawinigan Falls and Three Rivers. From this power line the present and future industries will be supplied, making this district very attractive for industries, as there is plenty of cheap power available and good transportation facilities by water and rail.

NITROGEN A COMPOUND?

Shall we be obliged to relearn our chemistry? Nitrogen has always been looked upon as a staid element. Sir Ernest Rutherford, as reported in the *Manchester Guardian*, states that it is a compound. Oxygen has long since been suspected, but the elementary respectability of nitrogen seems unassailable, and most chemists will hope that N will remain N and not prove to be N or M.

Scientists, says the Manchester paper, have become familiar with what Sir Oliver Lodge (when lecturing recently at the Manchester University) styled "the Rutherford atom." Following Professor Rutherford's lucid descriptions (as given, for example, a few weeks ago, in his lecture at the College of Technology to the Engineering Society) we now see in the atom, once by its very name regarded as indivisible, a miniature solar system, with central massive nucleus, carrying a positive electric charge, surrounded by satellites in the form of negative electrons. This is, in a word, the "nucleus theory" of atomic structure.

Recent experiments with the alpha rays (the famous emanations from radium originally detected by Rutherford and Dorn) have led to a discovery which is sufficiently startling to be styled epoch-making. Nitrogen, which by a curious coincidence, states *The Dyer*, was first isolated in 1772 by the chemist D. Rutherford, and has for a century and a half been regarded and treated as an element, with an atomic weight of 14, is now suspected to be, not an element at all, but a compound of hydrogen and helium: the helium forming the central sun or nucleus of the system, the hydrogen nuclei appearing as satellites. The combining weight of 14 is explained as due to a central nucleus of three helium nuclei, each of mass 4, the remaining two being accounted for by the hydrogen satellites.

It is another interesting coincidence that Dr. Dalton, according to the now accepted account, was first led to his ideas of the atomic structure of matter by a study of the physical properties of the atmosphere. Sir Ernest, by experiments on the same gases, now sees in each of Dalton's atoms of nitrogen an atomic system in which two distinct elements play a part, while nitrogen itself, as an element, is apparently to disappear altogether.

Finally, it is a third interesting coincidence that Sir Ernest Rutherford should announce this remarkable discovery in the very building where Dalton made his famous experiments and where his apparatus is still preserved with scrupulous care.

NEW ALKALOID REPORTED.

The chemists of the United States Department of Agriculture, in conjunction with the Bureau of Plant Industry, claim to have extracted a new alkaloid from the plant called in Mexico "Gobernadora," the "Covillea tridentata" of botanists, which grows in the semi-arid districts of Mexico, New Mexico, etc. The odorous characteristics and medical properties of this plant have long been known to natives and explorers, but it is only just recently that the presence of a new alkaloid has been recognized. The possibilities of this alkaloid in chemical and pharmaceutical preparations are now being ascertained.

"Gobernadora" is a shrub which grows in vast quantities in the States of Zacatecas, San Luis Potosi, Coahuila and Durango, a little north of the Tropic of Cancer, in about the same zone as guayule is cultivated. It grows to a height of from one to one-and-a-half metres. It is estimated that a million tons of ashes, rich in potash, can be produced yearly from the green shrub now growing. It takes about one year for the plant to develop from same roots after cutting. The leaves smell of iodoform.

It is stated that in 1912 two German chemists obtained permission to make experiments on one of the haciendas situated in the States of Zacatecas and San Luis Potosi. Permission was granted on the understanding that they would furnish an exact report of their findings. The chemists made extensive experiments and disappeared without furnishing the report. Investigations indicate that after experimenting with several plants and shrubs they burned "Gobernadora," and apparently found satisfactory results in the ashes of this plant, as they departed immediately.

SIR WILLIAM RAMSAY MEMORIAL.

The movement in Great Britain to establish a fitting memorial to the late Sir William Ramsay, the great chemist, is succeeding admirably. Subscriptions are coming from all parts of the world. At a recent meeting at University College, London, of subscribers to the fund, presided over by Sir Hugh Bell, it was announced that $215,000 had been subscribed. Glasgow had raised $26,390, which it was hoped would be raised to a $30,000 total. Italy, Japan, Greece, Norway, and Spain had either entered into definite undertakings or had provisionally promised a fellowship or fellowships, to be tenable in the United Kingdom by chemists trained in their respective countries. Three proposals were submitted by the committee and unanimously approved by the meeting.

ACETYLENE

The General Properties of Acetylene and Its Application as a Tool in Industry

By R. A. WITHERSPOON*

ACETYLENE has come into such common usage in the past few years that we no longer ask "What is acetylene?" but it might add to the more general understanding of the following article to answer this question before proceeding.

General Properties.

Acetylene is a colorless and tasteless gas possessed of a peculiar penetrating odor. It is soluble in water approximately volume for volume, i.e., one gallon of water will dissolve a gallon of gas. It is considerably more soluble in certain other liquids, such as alcohol, ether, petroleum, turpentine, and especially in acetone. We will have occasion to refer again to this last solvent. Acetylene has a specific gravity of 0.91, which means that it is 91% as heavy as air. In comparison, coal gas has a specific gravity of 0.43 and natural gas 0.56. Acetylene burns in air with a brilliant but smoky flame. When its illuminating power is properly brought out, as it is by the use of a suitable burner, it yields a light of greater brilliancy than that furnished by any other gas. The ignition point of acetylene is about 900° Fahrenheit or 200° Fahrenheit lower than that of coal gas. This is easily exhibited by allowing the gas from an acetylene burner to blow on to a cigar burning in the usual manner, without flame, when the gas will be ignited. Common illuminating gas cannot be lighted in this way. Acetylene in the gaseous form at ordinary pressure is not explosive in any sense, except as will be referred to later. Under comparatively light pressure, about 325 lb. to the square inch at 32° Fahrenheit or about 600 lb. per square inch at ordinary temperatures, a compression easily reached with ordinary pumping machinery, acetylene gas becomes a liquid. This liquid is said to be the lightest liquid known, being only four-tenths as heavy as water. It possesses also an expansibility greater than that of any other known liquid. Acetylene may also be had in the solid form, resembling snow, called acetylene snow, bearing as it does to liquid acetylene and gaseous acetylene the same relation that ordinary snow bears to water and steam, respectively. Acetylene is described chemically as C_2H_2, which means that it has a constant composition of twenty-four parts by weight of carbon and two of hydrogen or 92.3% carbon and 7.7% hydrogen. Being composed of these two elements only, it belongs to the class of compounds known as hydrocarbons, represented in nature by natural gas, petroleum, etc. There are hundreds of hydrocarbons of varying degrees of importance and usefulness, known to science, and there are many thousands of compounds containing carbon united with elements other than hydrogen, but among them all there is no gas containing a higher percentage weight of carbon than acetylene. Carbon is known in many forms as a fuel for combustion, and as a constituent of all fuels from whatever source and wherever employed, is in no place found more closely approaching the condition of pure carbon in the gaseous state than in acetylene. Hence, in answer to the question "What is acetylene?" it is interesting to note that at common temperatures, acetylene, containing only 7.7% of material other than carbon is our nearest approach to carbon in gaseous form, and we may therefore look upon acetylene as essentially gaseous carbon.

Acetylene Developments.

As early as 1836 Edmund Davy, an English chemist, observed the evolution of a gas which contained acetylene, but this was merely incidental to other experiments he was making at the time, and nothing more was recorded on the subject until 1862, when Woehler announced the discovery of acetylene prepared from calcium carbide which he had made in a very small quantity only, and by a most laborious process. These laboratory experiments, however, were not followed up, and acetylene seems to have been practically forgotten for the next thirty years. It was only after the discovery by Wilson, in 1892, that calcium carbide could be made commercially in the electric furnace that serious study was made of the properties and possibilities of acetylene. The early history of acetylene was thus closely bound up with that of the development in the manufacture of carbide. Suffice to say that after the first few years, the production and uses of acetylene became a science of its own.

Acetylene is evolved when carbide is decomposed by water in accordance with the following chemical equation:

$$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2$$

A pound of absolutely pure carbide yields five and three-quarters cubic feet of acetylene, but absolute chemical purity is not a practical commercial possibility, and in practice, good carbide may generally be expected to produce never less than four and a half cubic feet, measured at ordinary temperatures.

The combustion equation for acetylene is as follows:

$$2C_2H_2 + 5O_2 = 4CO_2 + 2H_2O$$

From the above equation it is easy to calculate that one measure of acetylene requires twelve and a half measures of air to produce complete combustion, and this is, therefore, the proportion for the most perfect explosion. All gases which burn in air will, when mixed with air previous to ignition, produce more or less violent explosions when fired. This is a perfectly general fact, as true for the gasoline in an engine cylinder as the illuminating gas in the city mains, or the overheated oil in the bowl of a kerosene lamp. Of course, acetylene is no exception, but it does not take fire of itself, although easily lighted.

A few years ago, when the commercial production of carbide was a novelty, most exaggerated accounts of its dangerous character were published in the newspapers. Now, everyone knows that carbide is a safe commodity. Transportation companies make no more objection to accepting a drum of carbide for shipment than they do to a keg of nails. Carbide may now be shipped on passenger vessels to any part of the world, and restrictions upon such shipments which formerly existed before its properties were fully understood, have been rescinded, or much modified.

Powers of Illumination.

As an illuminant, acetylene surpasses in lighting power most other known illuminants. Acetylene produces from twelve to thirteen times more light than illuminating gas, when the same quantities of each are consumed. When

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controlled by a suitable burner, the flame of acetylene is absolutely white and of intense brilliancy. It is the nearest approach to sunlight that we know, in fact, its spectrum so closely approaches that of sunlight that all colors appear the same as by daylight, instead of being distorted as is the case of gas, candle, oil or electric lights. Acetylene also pollutes the air, i.e., robs the air of its oxygen and throws off carbon dioxide, less than does illuminating gas.

But to bring out the above-mentioned qualities of acetylene as an illuminant, a suitable burner must be used. In attempting to use the gas in an ordinary gas burner, the light was found to be unsatisfactory on account of the excess of carbon it contained causing acetylene to burn with a smoky flame and throwing off large quantities of soot. The first and most serious problem was that of finding a burner in which acetylene could be consumed without the nuisance of smoking and clogging. This was caused by the burner of ordinary form becoming too hot, polymerizing the gas and clogging the passages with soot, due to the fact that the ordinary burner was not designed to mix sufficient quantity of air to burn a gas so rich in carbon. Large amounts of money were offered in the way of prizes for the invention of a method by which this gas could be used as an illuminating medium. Geo. Bray & Co., well known throughout the world as manufacturers of gas burners, were among the first to solve the problem. This they did by means of a burner in which two small jets of acetylene are discharged from two different points in the burner and so directed that they impinge upon each other at a distance of about half an inch from the burner, forming a flame which stands at right angles to the plane in which the jets lie. These jets also carry air with them, taken in at the burner in a manner very similar to that of the Bunsen burner. The injected air is merely sufficient to bring about a complete and smokeless combustion, while the flame is so far removed that the burner scarcely becomes heated. This style of burner has been improved upon by Naphy, and other makers, since the original was brought into practical use, but essentially the principle remains the same as above.

Acetylene Generators.

Before taking up the uses to which acetylene has been put, it will be necessary to give some attention to the important subject of acetylene generators and the principles underlying the generation of this gas from carbide. The first principle and the one of the utmost importance in acetylene manufacture is that of cool generation. The reaction between carbide and water is, as is well known, strongly exothermic. According to the method by which the carbide and water are brought together, this heat may be either so localized as to have harmful potentialities, or so distributed as to be incapable of causing harm. When a small piece of carbide is dropped into a pail of water the heat of the reaction is so absorbed in the relatively large mass of water that overheating at any point does not occur. On the other hand, when water, drop by drop, is allowed to fall upon a lump of carbide, chemical reaction is localized, overheating occurs and the resultant gas is partially converted into oily substances and even into tar. This polymerization, while of possible value to the chemist, has no place in the acetylene generator. These oily, tarry substances, caused by overheating, result in a loss of acetylene and the clogging of pipes and burners. The remedy for these troubles and possible sources of danger is prevention, the means of which is cool generation. The best practice of to-day has established what may be considered as a fundamental rule in acetylene generation: the use of one gallon of water to every pound of carbide.

Acetylene generators have been made in many different types, which, for the purposes of description, may be grouped in three general classes.

1st. *By Displacement or Pressure Regulation.*—In generators of this type water is allowed to come into contact with carbide from below. As gas is given off, the resultant pressure drives back the water until such time as the gas is released through the service pipe. With the consequent reduction of pressure, water is again admitted into contact with the carbide, when more gas is generated and the above process is repeated.

2nd. *Water-to-Carbide.*—This type of generator usually consists of two parts, the generator proper and a gas holder. A quantity of carbide is placed in a receptacle and sprinkled with water in such quantities as will produce the requisite amount of gas. The gas holder, or bell, is fitted with a valve so arranged that the rise and fall of the gasometer when filling and emptying respectively closes and opens the valve, thus controlling the supply of water to be sprinkled on the carbide. As long as these generators are kept properly supplied with carbide and water, the automatic action maintains a steady supply of gas. Such a generator is especially adapted to localities where running water is not available, and where it is not possible or convenient to connect with drainage pipes that are ample for the removal of sludge and for flushing. The sludge is carried away in the carbide receptacle and water is brought to the machine in buckets.

3rd. *Carbide-to-Water.* — The modern carbide-to-water type of generator also consists of two parts: generator and gas holder. The generator proper consists of a hopper which holds the carbide and which is fitted with a feeding mechanism to control it and to admit of its dropping into the water, contained in the tank below, at the right time and in small regulated quantities. As gas is generated the bell rises, arresting the feed until such time as the fall of the gasometer again releases the mechanism which starts the feeding, thus maintaining such a rate of supply as is called for by service demands. This type is the one most commonly used in North America, and of it Professor Lewes, English chemist and authority on illuminating gases, wrote early in 1898:

"The generators of the carbide-to-water type are undoubtedly the best as, with the water kept in excess, it is impossible for the temperature to rise above the boiling point of water, and under all conditions this class of generator yields the purest gas, as the acetylene, having to bubble through the lime water, formed in the generator, is washed free from most of its impurities." Also, still referring to generators of the same class: "With a properly arranged tank the temperature never exceeds the air temperature by more than a few degrees. Under these conditions, the absence of polymerization and the washing of the nascent and finely divided bubbles of gas by the lime water, in the generator, yields acetylene of a degree of purity unapproached in any other form of apparatus."

Town Generators.

At first, generators were installed in single buildings where it soon became popular, especially in the rural districts, lighting farmhouses and buildings, as well as rural stores. Soon it was found to be convenient, when installing a generator, to put in one considerably larger than was required for the building on which it was placed, and to pipe the excess gas to a neighboring building or buildings. The

evolution of the town-plant was a natural and logical sequence. There are many towns in Canada to-day lighted by acetylene on much the same principle as coal gas is supplied in large cities. Instead of placing a generator in each house for the convenience of individual customers, a large generator is installed in a suitable location on the outskirts of the town, a distributing system is laid out and gas is supplied to the customer on a meter basis, as is illuminating gas in the city. This system of lighting is very popular in towns of from five hundred to two thousand population, especially so in Canada, west of Winnipeg, also in Australia, New Zealand and South Africa, where hydro-electric power is seldom available, and the cost of coal for steam-generated electric power is expensive. It is worthy of mention that in the case of such a town plant, the gas is available for light or fuel at all hours of the day or night, while in many cases with other methods of lighting, particularly with electric power supplied by a small plant, the lights are available at certain hours only, usually until midnight, necessitating the use of some other form of lighting during the hours the electric plant is not in operation. It is also noteworthy that engineers are agreed upon the superiority of the illumination, both domestic and municipal, enjoyed by the residents of the great majority of these acetylene-lighted towns, over that supplied in any of the larger cities.

Science has made great advances during the last few years and in no direction has this progress been more beneficiently shown than in artificial ventilation and illumination. Good lighting means a cheerful home as well as a saving of eye strain. Much of the eye strain, necessitating the use of eyeglasses, altogether too common this present day, can be directly traced to the time when children and young people were forced to study their lessons by the light of the fire-place or of a fitful kerosene lamp. The natural result was a weakening of the eyes of our present generation. Let us not pass on to the coming generation an evil which can be so easily and cheaply eliminated.

But the very qualities that caused acetylene to attain early in its history such an advanced position as a domestic and municipal illuminant, namely, efficiency, economy and a minimum of care in operation, were the same ones which influenced large industries, railroads and governments to take advantage of the benefits to be derived from the use of this same light.

The bicycle and automobile manufacturers quickly saw and used its advantage over older and less reliable methods of lighting. Yacht builders equipped their floating palaces with this desirable light. The mining industry finally adopted the use of acetylene in miners' lamps.

Uses on Railways and Waterways.

To railroad officials of all countries, the advantage of acetylene, as an illuminant, made an early appeal. While it is not possible to secure such high candle power as with an electrical arc headlight, acetylene light is far more efficient and satisfactory, and at one-fifth the cost of electricity. Many of the leading railroads are adopting acetylene for their locomotives for the following reasons: Electric headlights do not increase the safety of trains because they prevent engineers on opposing trains from properly distinguishing signals, because they increase rather than diminish danger in yards due to their dazzling brilliancy, because they daze live stock which may have strayed on to the tracks, and because they are liable to cause red, yellow and green signals, which are signs of caution and danger, to appear colorless and thus be interpreted as meaning safety. But the railroad uses of acetylene are not limited to headlights, many railroads now using it for lighting their coaches, parlor, mail and dining cars, railway stations and yards, and for signal lights in towns.

In 1912, the Nobel prize of forty thousand dollars for the most noted invention or discovery of the year, in physics, was awarded to Gustav Dahlen, of Stockholm, by virtue of his inventions in connection with acetylene lighthouses and other aids to navigation. Dahlen's automatic acetylene flashing mechanism by which the duration of flash and interval was controlled, together with his invention and development of the sun valve, an instrument which automatically turns off the lights at the approach of day and throws them on again when a certain degree of darkness occurs, no matter whether such darkness is due to cloudy weather, fog, twilight or total eclipse, marked a new epoch in the safety of travel by water. These great improvements in aids to navigation have now been extended to all parts of the globe. Every year sees more acetylene lighthouses, beacons and buoys placed in operation. There are buoys in favorable positions which flash brilliantly at dark and halt during the lighter hours, unceasingly signalling their silent message to the sailor, without needing the care of a human visitor for full two years.

Solubility of Acetylene in Acetone.

Of fundamental importance in the acetylene industry is its solubility in acetone, one of the products of the distillation of wood, and prepared also in other ways, one of the most interesting of which is from acetylene gas itself. Acetone is a peculiarly excellent solvent for acetylene which dissolves in it, freely absorbing twenty-four timse its own bulk at ordinary temperature and pressure, and for each additional atmosphere of pressure to which it is subjected, a similar quantity will be dissolved. We have seen that acetylene, when compressed, became so dangerous that the practice has been given up. But if the gas be forced into acetone, a solution is obtained which is devoid of danger and can be readily handled and safely transported under all conditions. The method of preparing dissolved acetylene is as follows: The gas is generated in the usual way, washed, purified and dried. It is then pumped into large storage tanks from which the compressors draw the gas, forcing it into steel containers, or cylinders, which have been previously packed with asbestos rings saturated with acetone, until the pressure reaches three hundred pounds to the square inch. The measure of safety claimed for this storage system, resides in the degree of perfection with which the cylinders are so completely packed with asbestos that there is no possibility of free or undissolved gas anywhere in the system. The gas issuing from these cylinders, when released, is at high pressure, and it is necessary to employ a pressure regulator to bring the pressure down to the correct extent for practical use.

Such apparatus, however, is easily secured, inexpensive and reliable, delivering acetylene at the burners, cool, dry and at uniform pressure. It is in this form that acetylene is most widely used on yachts, automobiles, railway coaches, locomotive headlights, marine buoys and beacons, and in the oxy-acetylene blowpipe.

Acetylene in Welding.

When acetylene is burned in air it produces a hot flame, but four-fifths of air is nitrogen, which, under normal conditions, is an inert gas. Now substitute oxygen for air and the temperature of the flame is wonderfully accelerated. We are all familiar with the oxy-hydrogen torch which en-

abled us to get a temperature of about four thousand degrees Fahrenheit. The principle of the oxy-acetylene torch is the same, but by its use we are enabled to command a temperature of between six and seven thousand degrees Fahrenheit, more than twice the hottest solid fuel heat known. The application of the oxy-acetylene flame to metallic welding as an industrial process, dated from 1903. The chemical reaction between oxygen and acetylene in the blowpipe differs somewhat from the combustion of acetylene in air, due to the fact that the oxygen is not diluted with nitrogen. Theoretically, the ratio of the two gases was placed by Leleatelier at equal volumes. In practice, rather more oxygen than this is required, say, from one and a quarter to one and a half volumes of oxygen to one of acetylene. Economy of oxygen is a measure of blowpipe efficiency, as is clearly shown when it is seen that acetylene combines with oxygen in the blowpipe according to the following chemical equation:

$$C_2H_2 + O_2 = 2CO + H_2$$

It is extremely important to note, as pointed out by Leleatelier, that the products of combustion, carbon monoxide and hydrogen, are both reducing agents. The fundamental importance of this cannot be overemphasized, as these reducing agents are neutral gases, incapable of changing either the physical or chemical character of the weld. They continue to burn in the outer regions of the flame outside of the welding zone, but by either one burning they contribute nothing to its temperature. In the hands of a skilled workman, however, this fact of changing the character of the flame at will constitutes one of the greatest advantages possessed by oxy-acetylene welding over all other methods. It is possible to make the flame "reducing," "carbonizing," "decarbonizing, "neutral," or "oxidizing," as may be desired, and thus accomplish such a variety of results in the character of the metal itself as any particular piece of work may demand. Malleable iron, cast iron, steel, copper, brass, bronze, aluminum and a variety of other metals, have all been successfully united so perfectly that when smoothed the joint cannot be discovered.

The Cutting Blowpipe.

Another striking application of acetylene is a method for the cutting of all forms of steel, by means of a blowpipe. The welding blowpipe cannot be practically used for cutting, but interchangeable tips are provided, so that a single apparatus may be quickly and readily changed from cutting to welding and *vice versa*, as the demand may require. The operator starts a cut by first heating the steel, then turning on a jet of oxygen. The cut, as the flame progresses, presents sharp surfaces, the metal on either side being neither fused nor injured in any way as the action proceeds too fast for the heat to spread. Any desired line of cutting may be obtained on straight lines, curves, circles, profiles and bevels, as may be desired, and on any thickness of metal up to sixteen or twenty inches. An instrument known as the oxygraph, consists of an ingeniously arranged pantograph in which the blowpipe is carried midway between the axis and the guiding point, always moving parallel to the latter, and is used in cutting designs. It is only necessary to control the movement of the guiding point, keeping it on line of the design, while the blowpipe, in a uniform position, and moving at a uniform rate, cuts out the design. By superimposing several plates at once several duplicates may be produced at one time, up to the cutting capacity of the torch.

The Field for Welding.

Oxy-acetylene welding and cutting have come into such continuous and increasing application, that it is entirely beyond the province of this article to enumerate the miscellaneous and endless list of things that are, every day, submitted to the action of the acetylene torch. Suffice to say that it is used by contractors and builders of bridges, ships, motor boats, automobiles and airplanes; workers of practically all metals, as well as blacksmiths, coppersmiths and plumbers, manufacturers of boilers, safes, locomotives and armorplate, blast furnaces, breweries, chemical works, and coal-gas plants; infoundries, mines and mills, such as textile, paint, sugar, cement or grist mills; in repair shops, machine shops and garages; by shipbuilding yards and junk dealers; for the manufacture of steel sash windows and doors, umbrellas, and a long list of new articles, as well as for repair of almost every imaginable variety of broken and worn mechanisms.

These many and varied uses for acetylene all over the world mean the generation of millions of cubic feet of gas daily and by their normal growth from year to year would alone insure to the carbide industry a prosperous future. But new and important uses are being developed which bid fair to outstrip in their consumption of acetylene, the old and established uses. These uses are the manufacture of chemicals using acetylene as the raw product.

Starting with two refractory inorganic materials, lime and coke, converted through the agency of the electric furnace into carbide, an inorganic solid compound which, decomposed by water, yields acetylene, an unsaturated, hydrocarbon gas, we now suddenly enter that wonderful field of organic chemistry.

The possibilities of acetylene in this connection are dealt with fully in the following article.

EFFECTS OF CARELESS HANDLING.

Dr. A. McGill, Chief Dominion Analyst, Ottawa, has issued a warning to druggists throughout Canada regarding the proper handling of the solution of ethyl nitrite, known as spirits of nitrous ether, or sweet spirits of nitre. The inspectors of the Food and Drugs Laboratory have found many samples of this solution deteriorated, due, not to dishonest manufacture, but to carelessness in handling in the shops, such as using of white glass bottles and loosely fitting corks. Ethyl nitrite is easily decomposed. Dr. McGill states, therefore, that he intends to hold the retail druggist alone responsible for the character of the product.

SALT DEPOSITS IN ATHABASKA.

Hon. J. L. Cote and Prof. J. A. Allan, of Alberta, have completed an investigation into the salt deposits of along the Athabaska River, and, as a result, predict that the industrial operations of these salt deposits will commence at an early date. Professor Allan made a thorough examination of working conditions and the topography of the country. Drillings at Fort McMurray, 540 feet deep, were examined. Numerous saline springs were discovered, but in every instance these were at a cnsiderable depth. The bituminous sands along the Athabaska River were also examined, but industrial development of these depends on laboratory investigation of them, now being conducted at McGill University.

The Commercial Synthesis of Organic Compounds From Acetylene

A Summary and Review of the Possibilities of Manufacturing a Large Number of Organic Products Based on Hydration, Chlorination and Addition Compounds of Acetylene

By M. J. MARSHALL*

WHILE the use of acetylene as an illuminant has been well known for many years, its use in the commercial synthesis of organic chemical compounds is of more recent origin. However, the possible commercial utility of acetylene gas, on account of its very high chemical reactivity, has long been recognized by chemists, and attempts to utilize it in this manner date back probably just as far as its use as an illuminant.

This property of acetylene is due largely to the fact that it is a highly unsaturated compound of simple structure, having the formula CH:CH. Thus, not only does it react easily with other compounds, but at the same time the reaction products are quite simple in structure, thus making it possible to manufacture compounds which can be used as starting points in a large number of chemical syntheses. This high reactivity of acetylene makes the number of possible syntheses very large in number, but up to the present time only a comparatively small number of these reactions have been developed commercially.

The present article will not be confined merely to compounds which have been produced on a commercial scale, but patented processes will also be included, as a large number of these embryo processes are certain to be commercially successful in the future.

As was mentioned above, acetylene is an unsaturated compound, and can therefore form additional products with other compounds. At the same time, acetylene can be polymerized by heating to a sufficiently high temperature, decomposed into its elements by detonation under high pressure, or oxidized either directly or by electrolysis.

Hydration of Acetylene.

The most important reaction at the present time, from a commercial and technical point of view, is the hydration of acetylene gas to form acetaldehyde, itself the source of many important synthetic compounds. This reaction proceeds according to the equation:

$$C_2H_2 + H_2O = CH_3.CHO$$

and takes place only in the presence of salts of mercury. The reaction was the subject of many patents, but it was not operated on a commercial scale till 1916, when the Shawinigan Water & Power Co., at the request of the British Government, successfully installed and operated the process with the aim of producing acetone for the manufacture of cordite. For this purpose a subsidiary company was formed, under the name of the Canadian Electro Products Co. The process of this company consists briefly of the following steps:

(1) The production of acetaldehyde from acetylene by passing acetylene gas through large kettles containing aqueous solutions of mercury salts. The aldehyde vapor is separated from the excess acetylene gas by refrigeration. This is then rectified to give a pure acetaldehyde of 99.9% purity.

(2) Oxidation of the aldehyde to acetic acid in the presence of appropriate catalysts. This is effected by passing air or oxygen through the aldehyde under pressure in the presence of catalysts, such as vanadium pentoxide, cerium oxide, manganese acetate, etc. The degree of conversion of the aldehyde to acetic acid is very high. After separating the excess aldehyde by rectification, acetic acid running 99.8% pure can be obtained.

(3) Conversion of the acetic acid to acetone by passage through hot tubes over lime as a catalyst. This proceeds according to the equation:

$$2CH_3COOH = (CH_3)_2CO + CO_2 + H_2O$$

This process was operated with reasonable success for about one year, the acetone being shipped to the British Government. However, towards the end of 1917 the manufacture of acetone was stopped and acetic acid was produced and shipped to the British Government as before. It is not probable that the company will resume the manufacture of acetone, as this material can be produced more cheaply from commercial calcium acetate. It is understood that a plant of this type for the production of acetic acid has been in operation in Germany since 1916.

Other Products from Acetaldehyde.

While, therefore, at the present time acetic acid is the main product manufactured from acetaldehyde on a commercial scale, there is no doubt that in the near future acetaldehyde will be the source of many other important organic compounds. This substance is even more wonderful than acetylene with respect to the great variety of reactions in which it can take part.

Paraldehyde.—Another product which has been manufactured for some time by the Canadian Electro Products Co. is paraldehyde. This is manufactured by treating pure acetaldehyde with very small amounts of sulphuric acid. Considerable heat is evolved, and the aldehyde is converted to paraldehyde containing a certain amount of excess aldehyde. This excess aldehyde is finally removed by appropriate means, in order to obtain the pure paraldehyde.

Aldol.—While mineral acids tend to cause acetaldehyde to polymerize to paraldehyde; aqueous solutions of alkalis, on the other hand, cause the so-called aldol condensation, according to the equation:

$$2CH_3.CHO = CH_3.CH(OH).CH_2.CHO$$

Thus N. Grunstein (U.S.P. 1234156, Br.P. 101636 (1917) protects the production of aldol by treating acetaldehyde with calcium or strontium oxide, and a little water. On completion of the reaction this mixture is neutralized with acid and the aldol is separated by distillation in vacuo. Aldol has been proposed for the preparation of cellulose acetate solvents. It is also used as a source of butadiene for the manufacture of synthetic rubber.

Ethyl Acetate.—If pure acetaldehyde is allowed to stand for about four hours in contact with about 5% of its weight of finely divided aluminium ethylate, about 90% is converted directly to ethyl acetate, according to the equation:

$$2CH_3.CHO = C_2H_5OOC.CH_3$$

It should be noticed that this reaction involves the polymerization of two molecules of acetaldehyde as in the formation of aldol, although the resulting product is en-

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tirely different. This is one very good example of the great diversity of reactions in which acetaldehyde can take place.

From a technical point of view, this is a promising reaction, as the ethyl acetate produced is of very high quality, while the means necessary to effect the actual conversion are very simple. The great drawback at present, however, is the preparation of the aluminium ethylate. German patent No. 286596 (1913) claims the preparation of this catalyst by the action of anhydrous alcohol on aluminium foil in the presence of a small amount of mercuric chloride. This action is not by any means rapid, and, after solution of the aluminium, it is necessary to free the aluminium ethylate from the alcohol and mercuric salt. This last has also been the subject of several patents.

Acetal.—Acetal is often used instead of aldehyde for carrying out condensation reactions. It results from the combination of ethyl alcohol and acetaldehyde, according to the equation:

$$2C_2H_5OH + CH_3.CHO = CH_3.CH(OC_2H_5)_2$$

It is prepared by mixing acetaldehyde and ethyl alcohol in the presence of a trace of hydrochloric acid, and an amount of calcium chloride equivalent to 10% of the weight of the liquid. Two layers form, which are separated, and the upper one repeatedly treated with fresh portions of calcium chloride till no more water separates. The liquid is then shaken with anhydrous sodium carbonate to remove traces of acid, filtered, and fractionally distilled.

Ethyl Alcohol.—Patents have been taken out for the preparation of ethyl alcohol from acetaldehyde by passing a mixture of acetaldehyde vapor and hydrogen over reduced nickel at temperatures below 180°. It is hardly probable, however, that alcohol can be produced as cheaply by this method as by the ordinary fermentation process.

Aldehyde Ammonia.—Aldehyde ammonia has recently come to the fore as an accelerator in the vulcanization of rubber. This can be prepared by the direct addition of ammonia to aldehyde. The aldehyde is dissolved in anhydrous ether and dry ammonia gas passed through. The aldehyde ammonia separates as a crystalline solid, which can be separated by filtration.

Chlorination Products of Aldehyde.—Acetaldehyde chlorinates very rapidly, with the evolution of much heat. A mixture of several products is obtained, which, so far have not found any large commercial use. It is stated that acetyl chloride is formed in this way, although the amount so formed is not sufficiently large to be of technical importance. One of the products appears to be butyl chloral. On the whole, however, very little exact information is available so far concerning the exact nature of the reactions accompanying the chlorination of aldehyde.

Manufacture of Pure Nitrogen.—In the oxidation of aldehyde to acetic acid by means of air, considerable amounts of fairly pure atmospheric nitrogen are obtained. This by-product should certainly find a use in one of the several nitrogen fixation processes at present in existence.

Products from Acetic Acid.

From acetic acid a number of interesting products are obtained. Thus by passing chlorine gas into acetic acid in the presence of acetic anhydride monochloracetic acid is obtained. This product is of great importance in the manufacture of indigo.

Acetone.—If acetic acid vapor is passed over lime at a temperature of 450° C. practically all the acid is converted to acetone, with the liberation of carbon dioxide, according to the following equation:

$$2CH_3COOH = (CH_3)_2CO + CO_2 + H_2O.$$

It can be seen that in this case the lime acts as a catalyst only. As was mentioned before in connection with the description of the process of the Canadian Electro Products Co., this method of manufacturing acetone cannot compete financially with the ordinary method, consisting of the dry distillation of commercial calcium acetate. This is due to the high initial cost of the acetic acid compared with that of the acetate of lime.

Manufacture of Acetic Anhydride.—Acetic anhydride is an acetic acid derivative of extreme technical importance. It is used very largely in the manufacture of cellulose acetate and synthetic drugs. While cellulose acetate is a more valuable product than cellulose nitrate, nevertheless, at the present time the high cost of acetic anhydride limits its use considerably.

A method for the manufacture of acetic anhydride directly from acetaldehyde has been patented by Societe L'Oyonnith (Fr. Pats. 420346 (1910) 442738 (1911). The aldehyde is diluted with acetic anhydride and treated with chlorous anhydride, Cl_2O. The following reactions are stated to take place:

$$Cl_2O + 2CH_3.CHO = (CH_3CO)_2O + 2HCl$$

This process, therefore, supplies a means for the production of acetic anhydride directly from aldehyde, without the intermediate formation of acetic acid or an acetate.

Not only can acetylene add on free water to form acetaldehyde, but it can also form aldehyde by actually abstracting water from other chemical compounds, and thus acting as a dehydrating agent. Thus acetylene dehydrates acetic acid in the presence of mercury salts to form acetis anhydride ande acetylates. The anhydride so formed immediately acetylates the aldehyde to form an ester of the ethylidene type, known as ethylidene diacetate. If this substance is heated, it tends to break up into aldehyde and acetic anhydride. This last reaction, therefore, opens a door for the manufacture of acetic anhydride directly from acetylene. Considerable attention had been devoted recently to the development of this process in Europe, but there seems to be a number of fundamental difficulties which have not yet been overcome.

The ordinary technical method of manufacturing acetic anhydride is by the action of chlorides of sulphur on sodium acetate. This process has been modified by Goldschmidt (U.S.P. 1195205 [1906]) by mixing sulphur with the sodium acetate and passing in chlorine. In this way the sulphur chloride is formed in contact with the substance on which it is to react. The first product of the reaction is acetyl chloride. This reacts with the excess of sodium acetate at a higher temperature—about 80° C.—to form acetic anhydride. The acetic anhydride is separated from the solid residue by distillation in vacuo.

Compounds of Acetylene With Other Substances.—It was found that acetylene in the presence of mercury salt could abstract water not only from acetic acid, but also from most compounds containing a hydroxyl group. G. Boiteau (Fr. Pat. 477560 [1914]) claims the manufacture of entirely new compounds by the action of acetylene on alcohols. Also by dehydrating the product obtained from methyl alcohol and acetylene, he obtains butadiene. It would appear, therefore, that this series of reactions alone opens a very wide field to the utilization of acetylene.

Compounds With Ammonia.—By passing a mixture of ammonia and acetic acid vapor over alumina at 500° C. acetonitrile is formed, according to the following equation:

$$CH_3COOH + NH_3 = CH_3CN + 2H_2O$$

The yield is 85% of theory. The nitriles, as is well known, are important substances in organic syntheses.

Esters of Acetic Acid.—It is doubtful whether the manufacture of the commercial grades of esters from high-grade acetic acid would be able to compete with the method of manufacture direct from calcium acetate as now practised. It is possible that where an ester of the higher alcohols were required of a fair degree of purity, acetic acid could be economically used.

It is perfectly obvious that this single property possessed by acetylene—that of adding on water in the presence of mercury salts—is possessed of vast potential industrial importance. Thus, while at the present time the main application of this reaction on a large scale has resulted in the commercial production of acetic acid, no one can prophesy how far the uses of acetylene as a synthetic medium will extend.

This power of adding on water is only one of a large number of additional reactions which can take place between acetylene and other compounds. The remainder of this article will be devoted to a discussion of these reactions.

Chlorination Products of Acetylene.

Acetylene combines very violently with chlorine, forming addition compounds. Care must be taken in controlling the reatction, otherwise it is liable to proceed with explosive violence. The main product of this reaction appears to be tetrachlorethane, $C_2H_2Cl_4$, although a little dichlorethylene, $C_2H_2Cl_2$, is formed at the same time. The following equations represent approximately the course of the reaction:

$$C_2H_2 + Cl_2 = C_2H_2Cl_2$$
$$C_2H_2Cl_2 + Cl_2 = C_2H_2Cl_4$$

Practically all patents taken out for the manufacture of tetrachlorethane by this method are for the purpose of preventing, as far as possible, the explosive combination of these gases. One of the most valuable methods appears to be that of Voigt, (U.S.P. 908051), who allows the reaction to take place in the interior of a porous mass made of sand, pulverized earthenware, infusorial earth, etc. The fine pores abstract the heat of reaction with sufficient speed to prevent explosion, while at the same time the apparatus is provided with a water jacket through which cold water is continually passed. The crude product obtained in this way is purified by fractional distillation.

Tetrachlorethane is a colorless, heavy, refractive liquid with a boiling point of 147.2° C. It is a very essential constituent of solvent mixtures for cellulose acetate dope. It is stated to give to cellulose acetate a resilient quality that no other solvent gives. In fact tetrachlorethane has in cellulose acetate much the same function as camphor in nitro-cellulose. Tetrachlorethane is also the starting point in the manufacture of other chlorinated hydrocarbons.

Dichlorethylene, $C_2H_2Cl_2$.—This is prepared by the suspending tetrachlorethane in water, and submitting it to the action of zinc dust. Considerable heat is evolved, and dichlorethylene distills off at 55° C. This substance is used as a solvent for cellulose acetate in conjunction with alcohol and tetrachlorethane.

Trichlorethylene.—This compound is also prepared from tetrachlorethane by abstracting one molecule of hydrochloric acid thus

$$CHCl_2.CHCl_2 = CHCl:CCl_2 + HCl$$

This is effected by treating tetrachlorethane with weak alkalis, or by passing the vapor of the same compound over surfaces of barium chloride or thorium oxide heated to 300°-390° C. when hydrochloric acid is split off.

Trichlorethylene has a boiling point of 88° C., and is a very efficient fat solvent. It has the advantage over tetrachlorethane of nat attacking metal vessels. Trichlorethylene is also important as the starting point of a whole series of valuable organic products. By acting on trichlorethylene with caustic soda, lime, and alcohol there is formed dichlorvinyl ether:

$$C_2HCl_3 + C_2H_5ONa = C_2HCl_2OC_2H_5 + NaCl$$

This compound is wonderfully reactive. One very important property is its combination with water in the presence of a trace of HCl at ordinary temperatures to form chloracetic ester thus:

$$C_2HCl_2OC_2H_5 + H_2O = C_2H_2ClOOC_2H_5 + HCl$$

Chloracetic ester is a compound which has been much used as a starting point for synthetic work. Chief among the products which can be synthesized in this way is indigo. The commercial manufacture of indigo, using acetylene as a starting point, is therefore possible.

Pentachlorethane and Hexachlorethane.—These compounds can also be prepared from tetrachlorethane by the acting on it with chlorine under the influence of actinic light. They are both used as constituents of solvent mixtures for cellulose acetate and cellulose nitrate.

Addition Products of Acetylene.

Hydrogen.—If acetylene and hydrogen are led over reduced nickel at a reasonably low temperature, ethane and a little ethylene are formed. It is claimed that ethylene alone is formed (Ger. Pat. 253160) when the acetylene is reduced in the presence of platinum or palladium, together with iron, nickel, cobalt, silver, magnesium, zinc, cadmium, or aluminium.

Ethylene is the source of many important compounds. Through its chlorination product, ethylene glycol can be prepared. With concentrated sulphuric acid we can form ethyl sulphuric acid, which, on treating with water, gives alcohol. On the other hand, ethylene, when condensed with acetone, gives isoprene directly, which makes the synthesis of rubber possible by this means.

Nitrogen.—It has been stated that a mixture of nitrogen and acetylene, when exposed to an electric discharge or actinic light, forms hydrocyanic acid, according to the equation $C_2H_2 + N_2 = 2HCN$.

This points out a method of nitrogen fixation hitherto untried on a large scale, although the cost of the acetylene may make the method too costly for commercial use.

Products Formed at High Temperatures.—Although acetylene will not combine with water to form acetaldehyde below 100° C. in the absence of mercury salts, nevertheless, if the acetylene, mixed with steam, is passed through a tube heated to about 400° to 600° C. in the presence of appropriate catalysts, acetaldehyde is formed according to U.S.P. 1244901. In this particular case the catalyst recommended is molybdic acid on asbestos.

Under similar circumstances, in the presence of partly reduced bauxite, it is found—British Pat. 109983 (1916)—that acetylene can add on H_2S to form thiophene, or ammonia to form acetonitriles, picoline, and other pyridine bases. The study of reactions of this type should form a very fruitful field for future research.

The great drawback to work with acetylene at high temperatures is the tendency to form polymerization products, which, together with any impurities in the gas, soon render the catalyst inactive, thus making it necessary to regenerate it quite frequently. At the same time it does not seem possible to obtain the products desired in any reasonable state of purity, a number of different substances being formed at the same time.

Acetylene Black and Hydrogen.

If acetylene is detonated under high pressure by means of the electric spark, a complete decomposition of the acetylene into its elements occurs, according to the equation

$C_2H_2 = 2C + H_2$. This occurs at atmospheric pressure between 260° and 600° C. Many patents have been taken out covering this reaction. In a large number of cases provision is made for collecting the hydrogen produced. If oxides of carbon are introduced along with the acetylene, these are reduced with the formation of water, no free hydrogen being produced in this case.

Electrolytic Oxidation Products of Acetylene.

If acetylene is submitted to electrolytic oxidation in acid solution, in the presence of mercury salts, acetic acid is produced directly, according to the equation:

$$C_2H_2 + H_2O = CH_3.CHO$$
$$CH_3CHO + O = CH_3COOH.$$

This method for the manufacture of acetic acid, so far, does not appear to have been utilized commercially, and it is very doubtful whether it can compete with the present synthetic process.

If electrolysis of the acetylene is allowed to take place in alkaline solution, on the other hand, salts of formic acid are produced. There is a possibility of reducing this formic acid to formaldehyde by reduction with hydrogen over reduced nickel. However, this process is not practicable at the present time, on account of the low yield of formaldehyde obtainable.

Compounds of Aromatic Series.

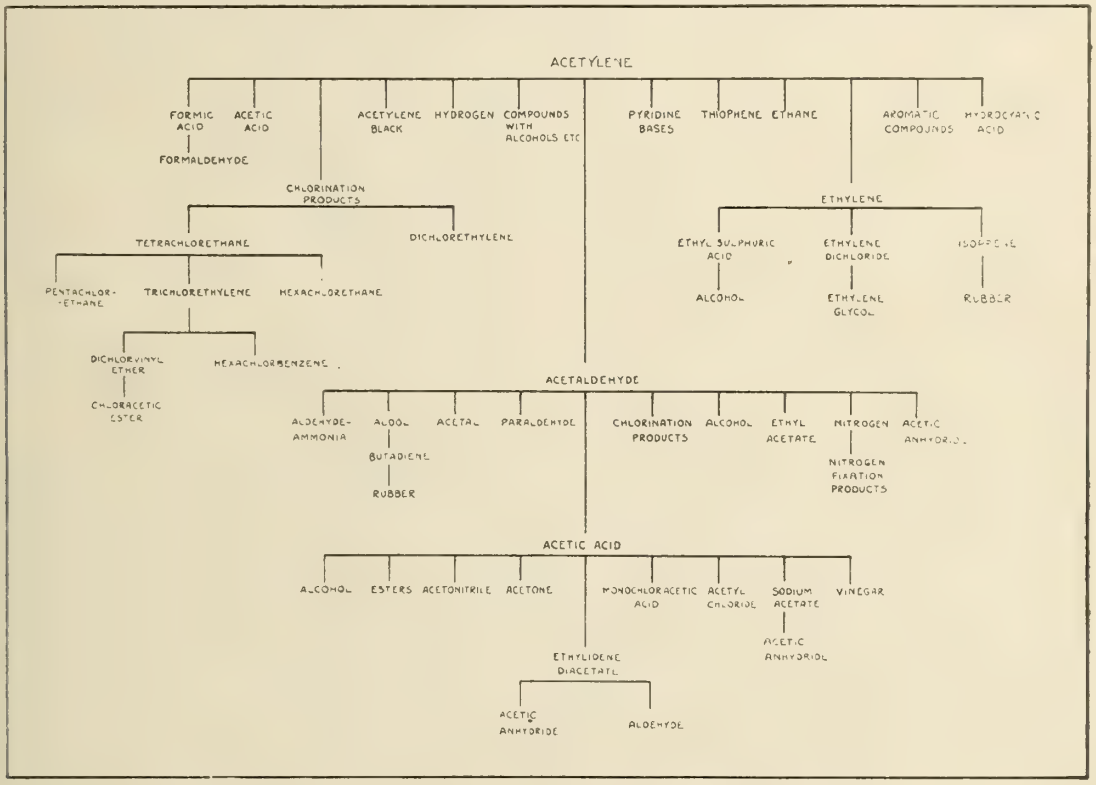
The polymerization of acetylene to benzene by passage through a hot tube is a well-known reaction. However, as benzene can be produced much more cheaply as a by-product in the coal distillation industry, this reaction is of no commercial significance.

Another possibility is the manufacture of phenol from acetylene by treating it with fuming sulphuric acid to obtain the sulphonic acid $(C_2H_2)_3(SO_4H)_4$. Phenol is obtained from the potassium salt of this acid by treating it with potash and distilling the product. So far, this process has not been utilized on a commercial scale.

Conclusion.

The numerous products which can be synthesized from acetylene are summarized in the accompanying diagram. When we consider that practically all these numerous compounds originate from a substance which is obtained directly from limestone and coke or carbon, we must realize the tremendous change which has taken place in our knowledge of organic chemistry since the classic synthesis of urea from ammonium cyanate by Woehler in 1828. In those days even the possibility of such syntheses as those described above was still a matter of controversy among chemists. It would, indeed, be interesting to hear the comments of the principals in these controversies if they could return to inspect our modern chemical industrial processes.

Many of the reactions of acetylene have not been applied technically, and there is a very wide field in this direction for the utilization of organic compounds which can only be manufactured at a high cost by other means. Even those processes for the utilization of acetylene which have so far been patented are still mostly in an undeveloped state. It can therefore be seen that the future of acetylene, as the source of many important organic compounds, is particularly bright. In fact, acetylene should, in time, stand in the same technical relation to compounds of the aliphatic series as benzene at the present time stands in relation to compounds of the aromatic series. Looking further into the future, it can be seen that calcium carbide will come to be of ever-increasing importance to the chemical industry. As the population of the earth increases the forests are bound to become more and more valuable, and all available farming land will be given over to the production of foodstuffs for human consumption. The present economic scale of values will then be entirely altered, and many of the above processes, which are valueless to-day, will then be in commercial use.



The Work of the Canadian Electro Products Company in the Synthetic Production of Acetic Acid and Acetone from Calcium Carbide*

By H. W. MATHESON†

POSSIBLY the most interesting chemical development at Shawinigan, and one of the notable achievements in the chemical world during the period of the war, has been the development of the process for the manufacture of acetic acid and acetone from calcium carbide.

During the year 1915, the demand for acetone by the British War Ministry became so great that the old sources of supply, viz., from calcium acetate, was entirely insufficient to meet the demands for cordite manufacture. Every possible source of new supply for this material was investigated. A plant was built at Baltimore, utilizing molasses, for the manufacture of calcium acetate. In California the utilization of kelp, by the Hercules Powder Company was developed. The British Acetones in Toronto, Canada, began to produce it from grain. These sources of supply, however, were, at that time, limited, the plants being in the development stage.

In the fall of 1915, the British authorities, in seeking a new source of supply, approached the Shawinigan Water & Power Co., to see if there were not a possibility of manufacturing the same from calcium carbide, there being in existence a considerable amount of literature and patents with regard to a possible process. The Shawinigan Water & Power Co. were the natural people to start work on a process of this kind, since they owned the waterpower and carbide plants at Shawinigan.

After a thorough study of the literature on this subject, a line of attack was decided on and experimental work started in December, 1915. During the ensuing six months extensive research was carried on by five Canadian chemists, with the result that in May, 1916, construction work was started on the buildings and equipment required for the large plant. By January, 1917, the plant, involving a very large expenditure of money and covering a territory of fifteen acres, was completed, and the first car of acetone shipped across the water early in January.

It would be impossible to recount in this paper the numerous difficulties and discouragements met with, not only in the preliminary experimental work but also in the initial operation of the plant. It must be borne in mind that each of the five processes involved were entirely new, and each presented its own peculiar difficulties, both chemical and mechanical. In practically every case, the process involved the design of entirely new and special equipment. In addition to this it was necessary to rush the work on account of the serious situation facing the British explosive industry, due to the insufficient supply of acetone.

Yet, in spite of this, the work was done so thoroughly that later on in the construction of a new plant for the United States Government, only a few minor changes were made in the design and arrangement of the equipment.

The process naturally divides itself into five stages:—

1st—Production of acetylene from calcium carbide.

2nd—Production of mercuric oxide from metallic mercury.

3rd—Production of acetaldehyde from acetylene.

4th—Oxidation of acetaldehyde to acetic acid.

5th—Conversion of acetic acid into acetone.

1st—Production of Acetylene from Calcium Carbide.

This reaction is well known and easily carried out, but this had only been done previously on a very small scale, involving the production of a few hundred cubic feet per

*Part of article read before Society of Chemical Industry, London, England, July, 1919.

†General Manager, Canadian Electro Products Co.

General View Plant of Canadian Electro Products Co., Shawinigan Falls, Que.

day for town lighting. This is quite a different proposition from the development of five hundred thousand to six hundred thousand cubic feet of gas per day, and the explosion hazard is considerable. This process, although by far the simplest of the five, gave considerable trouble before a machine was developed to manufacture the acetylene on the scale above mentioned.

2nd—Production of Mercuric Oxide from Metallic Mercury.

Mercuric oxygen is necessary as a catalyst in the production of aldehyde from acetylene in the next step of the process. The use of the standard method by which mercury was dissolved in nitric acid and then ignited to give mercuric oxide, was discarded from the standpoint of cost, and the work was concentrated on the oxidation of the mercury by electrolytic methods. After a great deal of experimental work, a process was developed by which mercury could be readily oxidized, utilizing a cast-iron cell, the bottom of the cell itself serving to conduct the current, a layer of the mercury resting on the bottom serving as an anode. Mercury oxide was formed on the mercury on the passage of the currents. The cell, as finally developed, consisted of a cast-iron pot, 6 ft. in diameter, 15 ins. high, with a stirrer sweeping the surface of the mercury to remove the oxide as formed. Caustic soda is used as an electrolyte, and the mercuric oxide as formed on the surface of the mercury is removed in suspension in the electrolyte. The oxide is then settled in settling tanks, the caustic returned to the cells for further use, and the mercuric oxide in a wet condition utilized as the catalyst in the next stage of the process. A large number of these cells were connected in series, to give the required production of mercuric oxide.

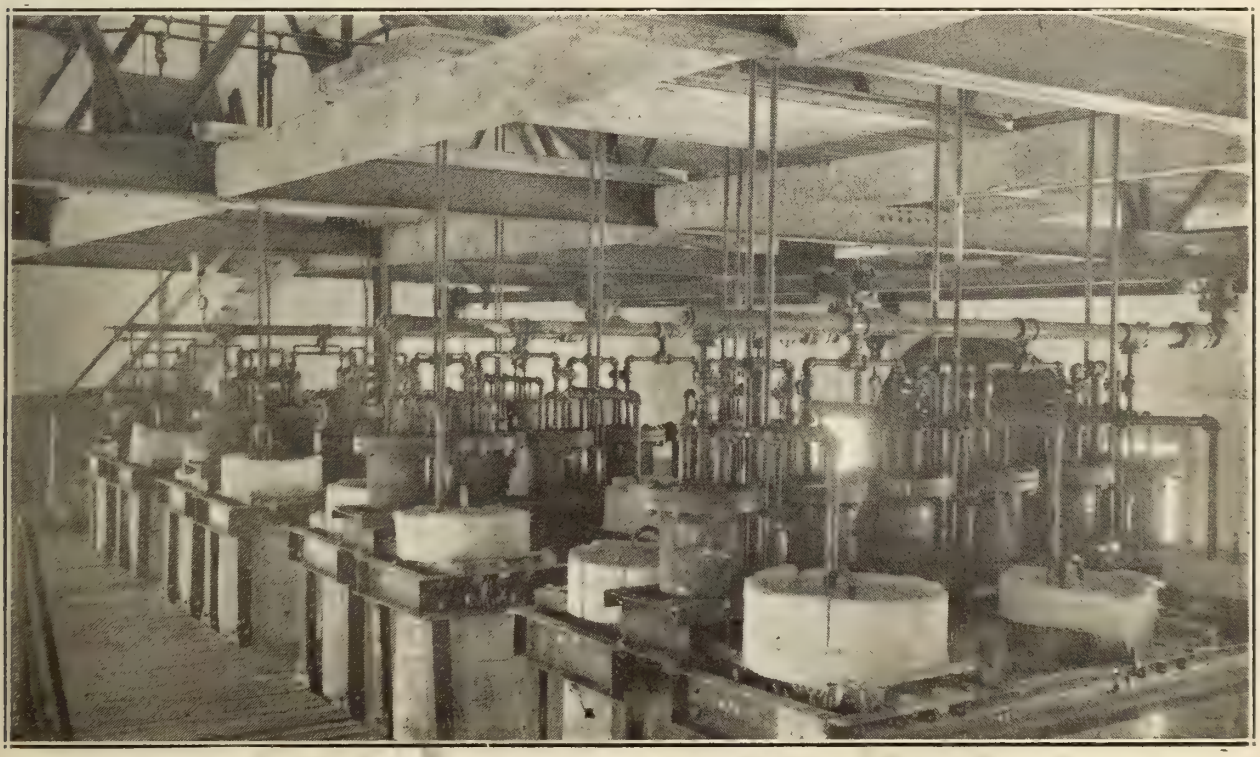
3rd—Production of Acetaldehyde from Acetylene.

The process for the production of aldehyde from acetylene gas was one of the most difficult to develop, principally from a mechanical standpoint. This process consists of passing acetylene gas into dilute sulphuric acid solution in which mercuric oxide is held in suspension by vigorous stirring, the oxide being fed in continuously as also the aldehyde is removed in the same manner by the use of a large excess of acetylene gas. The problem of securing a container which would withstand the action of dilute sulphuric acid, and at the same time resist the amalgamating action of the mercury, was a most serious one. This was finally overcome by the development of a special silicon iron of sufficient mechanical strength and of sufficient resistability to the action of the acid. The mercuric oxide used was reduced in the process in the formation of a fine sludge in suspension in the sulphuric acid. The problem of the recovery of this was also an extremely difficult one due to the fact that considerable of the mercury is obtained in the form of mercury organic compounds, and on decomposition of the sludge by heat, leaves a large amount of finely divided carbon. Furthermore, this problem presented further difficulties inasmuch as the highly poisonous character of the material involved the careful handling in specially designed equipment.

A large amount of refrigeration is required in condensing and storing the aldehyde and when the first plant was constructed, the total installation was equivalent to 450 tons of ice per day. This large installation was required for the summer weather, and during the winter months it was only operated to about 75% of its capacity.

4th—Oxidation of Acetaldehyde to Acetic Acid.

The first experimental work on this process consisted of the oxidation of the acetic acid by the use of oxygen. Experimental work was completed, using the oxygen, and in endeavoring to get Claude or Linde compressors for manufacturing the same, it was found impossible to secure them in a reasonable time. Necessity therefore compelled the development of a method by which air could be used, and as a result, by the use of specially designed conversion kettles, a process was successfully developed by which the



Top View showing Conversion Tubs and Evaporating Pots at Plant of Canadian Electro Products Co.

oxygen was completely removed from the air by the reaction, and as a by-product a large amount of nitrogen is turned free, consisting of about thirty tons per day.

Acetic acid manufactured consists of about 98% material, containing a very small amount of impurities. On one distillation acetic acid is obtained running 99% pure.

One of the features of this process was the securing of a suitable lining for the conversion kettles. Copper, iron, etc., could not be used, due primarily to the fact that the material acted as a surface catalyst, causing violent explosions. Aluminum was found to be the only suitable material for this purpose.

5th—Conversion of the Acetic Acid Into Acetone.

This reaction is fairly well known on a laboratory scale, experiments having been carried out by Squibb some years ago.

The experimental installation of this process consisted of three four-inch tubes, 6 ft. in length, heated electrically by means of a resistance winding, the acid being vaporized before passing into the tube. Using these tubes, a great number of experiments were carried out, to ascertain the most suitable type of catalyst to use and also the best type of carrier for the catalyst. The oxides and carbonates of the various alkali earth metals gave the most promise. Experiments were carried out on zinc carbonate, zinc oxides, manganese carbonate, witherite, etc., etc. It was finally found that with due regard to economy of operation the best results were obtained when hydrated lime was used, mixed with a small amount of magnesia. This was deposited on pumice stone by soaking the same in a thin paste of the catalyst. Very good yields were obtained by this process, ranging around 95% of the theory.

On passing to large-scale experiments, greater difficulties, however, were encountered, due primarily to the difficulty of heat transfer. Steel tubes were installed 13 ft. in length, 12 ins. in diameter. These tubes, under the same conditions, gave very poor results, due to the non-uniformity of the temperature inside the tube, the pumice stone being a very poor conductor. A centrally heated core was then installed in the tube, but this also gave poor results. The process as finally developed consisted of a steel tube of the dimensions as above, filled with rough-cast iron balls, on which the catalyst was placed by immersing the balls in the paste of the catalyst and drying the same in the tube by the passage of a current of air (Fig. 1 shows the design of this tube as installed). Seventy-two of these tubes were installed in this process for the production of ten tons of acetone per day.

The mixture of the vapors of acetone, water vapor and unconverted acetic acid was combined from 24 of these tubes to the one main leading to a soda ash scrubber, maintained at 98° C. by the heat from the gases, the soda ash removing the acetic acid unconverted which amounted to an verage of 5%, the acetone and water vapors passing through the condensers and scrubbers. The final product obtained consisted of a 20% solution of acetone in water and was rectified in a regular continuous acetone still. (Fig. 2 shows this process diagrammatically.)

It was found that the conversion was carried out most advantageously at a temperature of 485° C. Each tube was supplied with three thermo-couples, having leads to a central switchboard, and the temperature was maintained constant by installing the resistance windings in parallel, so that any of the parallel windings could be cut out as the temperature rose or fell.

It was found that the iron in the tube had a detrimental action on the conversion, due to the fact that it acted catalytically on acetic acid with formation of carbon black. This was not true of copper tubes, but the expense of installation of copper made their use prohibitive. This difficulty was largely eliminated by coating the walls of the tube with the catalyst itself. The life of the catalyst was approximately fourteen days, at the end of which time the balls were dumped and recoated.

The average efficiency for a period of months for this process was about 85%. The acetone manufactured was

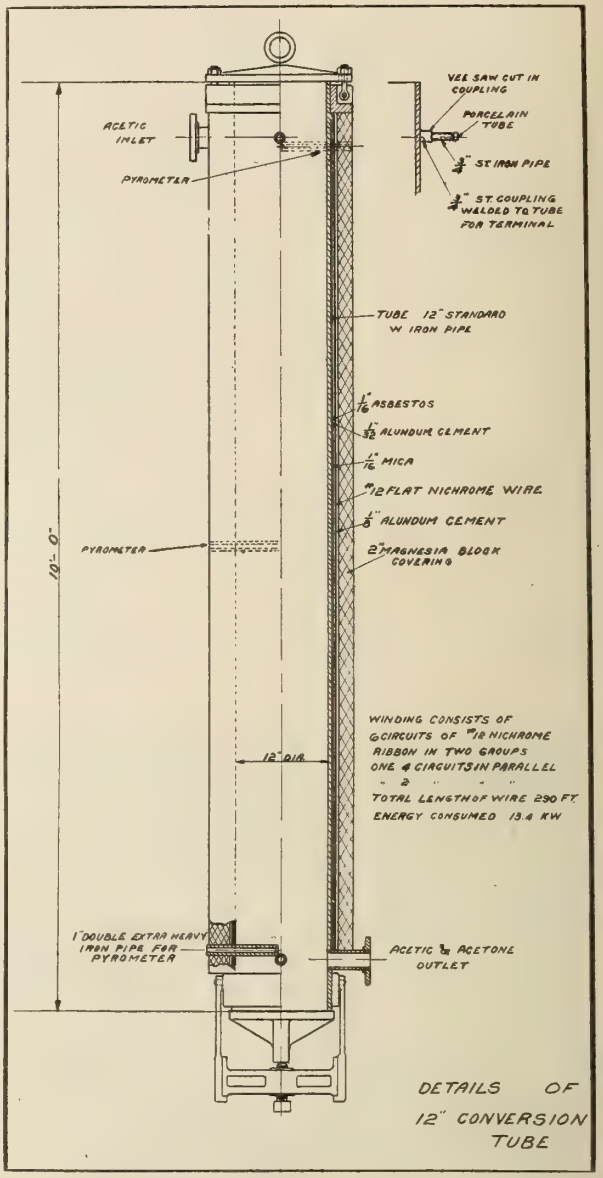

VEE SAW CUT IN COUPLING
PORCELAIN TUBE
ACETIC INLET
PYROMETER
½" ST. IRON PIPE
½" ST. COUPLING WELDED TO TUBE FOR TERMINAL
TUBE 12" STANDARD W. IRON PIPE
1/16" ASBESTOS
1/32" ALUNDUM CEMENT
1/16" MICA
#12 FLAT NICHROME WIRE
1/8" ALUNDUM CEMENT
2" MAGNESIA BLOCK COVERING
PYROMETER
10'-0"
WINDING CONSISTS OF 6 CIRCUITS OF #12 NICHROME RIBBON IN TWO GROUPS ONE 4 CIRCUITS IN PARALLEL " 2 " " " TOTAL LENGTH OF WIRE 290 FT. ENERGY CONSUMED 13.4 KW
12" DIA.
1" DOUBLE EXTRA HEAVY IRON PIPE FOR PYROMETER
ACETIC & ACETONE OUTLET
DETAILS OF 12" CONVERSION TUBE

Figure 1.

of the highest grade of purity, satisfactorily passing all government specifications.

It was realized at the outset that acetone would not be produced profitably, especially in peace times, by the conversion of glacial acetic acid. The requirements of the British Ministry of Munitions, however, made it necessary that the Canadian Electro Products Company manufacture acetone for a time. However, towards the fall of 1916, the demand for acetic acid became so great for the manufacture of cellulose acetate for aeroplane dope, that the last stage of the process was dropped, and from November, 1917, to

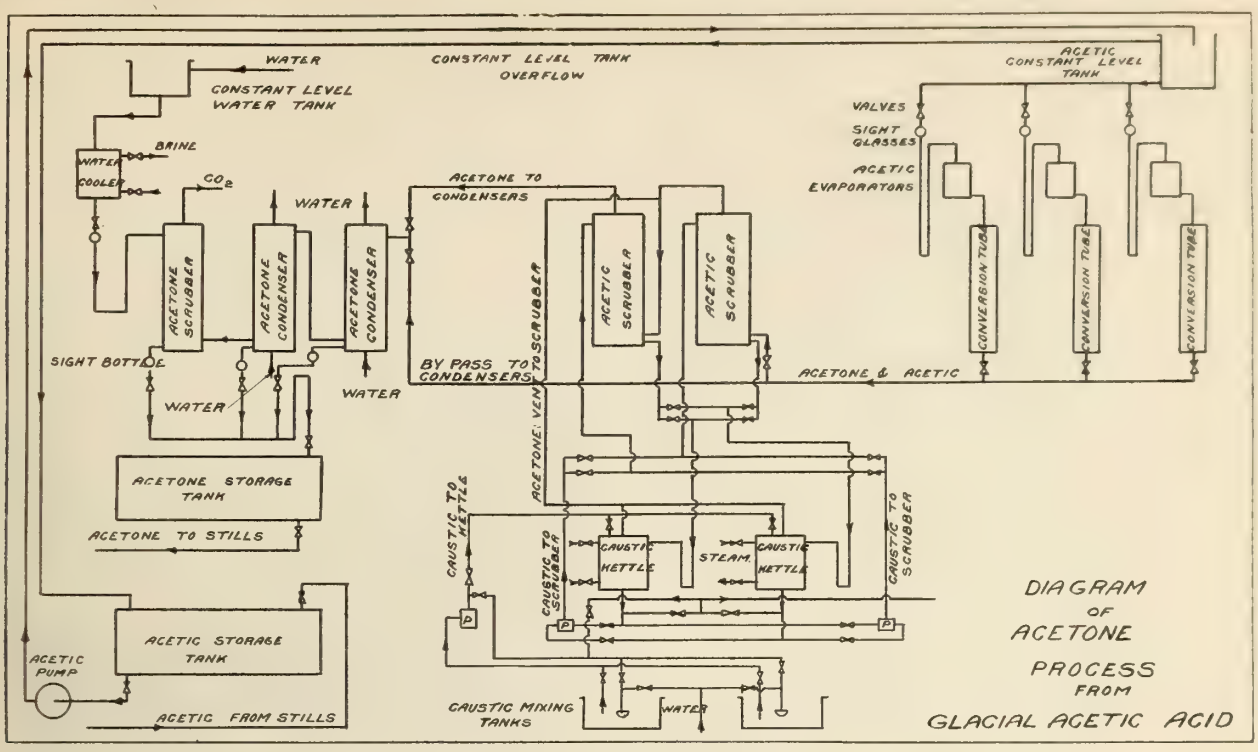


Figure 2.

the close of the war, the plant was utilized for the production of acetic acid only, during which period approximately ten thousand tons of glacial acetic were shipped to England.

When the United States entered the war the acetic acid demand was almost doubled. The United States Government was compelled to turn to Canada in order to obtain an adequate supply of this material. In March, 1918, construction was started on a duplicate plant for the American Government. When the armistice was signed, this plant was practically completed and ready for operation, although it had not turned out any material, the result being that at the close of the war the combined production of the two plants would have been approximately 1,600 tons of acetic acid per month, or equivalent to one-half the total calcium acetate production of the United States in terms of acetic acid.

With the war markets eliminated, the company has now turned vigorously towards marketing its product under peace conditions, and is now looking forward with every confidence to the future, not only as regards acetic acid, but is now making plans to produce all those products which can be manufactured from acetic acid and acetylene.

SURRENDER OF GERMAN COAL.

The Frankfurter Zeitung, a German newspaper, has the following to say in a recent issue regarding Germany's surrender of her coal areas:

"Germany's pit coal output on the 1st December, 1915, totalled 146,867,563 tons, but she is now to lose her coal-fields in Upper Silesia, while the Saar and Aix-la-Chapelle regions will remain outside her sphere of control. On the 1st December, 1915, the production in Upper Silesia was 38,106,787 tons, in the Saar region 10,345,417 tons, and in the Aix-la-Chapelle coal-field 2,251,260, or a total of 50,703,464 tons, i.e., 34.4 per cent. of the total German output. She is therefore left with a production of 96,164,099, but even this figure requires important modifications. The conditions of production have greatly changed since 1915. The average daily despatch of trucks in Rhenish Westphalia in peace time (1913) was 32,000; in February, 1919, after an improvement in conditions, it was 16,000. Germany's remaining coal output may, therefore, reasonably be placed at not more than 50,000,000 tons. Of this 50,000,000 she is for a period of ten years to be compelled to deliver 21.6 million tons to France, 6 million to Italy, 8 million to Belgium, 1.5 million to Luxemburg, or a total of 37.1 million, leaving for her own necessities 22.9 million tons of her own coal. The total export in 1911 was 31,145,076 tons out of a total output of 158,777,500 tons. Thus with an output only one-third as large, she is to export 20 per cent. more. This does not complete the chapter of her difficulties, for 74 per cent. of her pit coal production is to be delivered at prices fixed exclusively by the victors. Three-fourths of her coal output instead of helping to rescue her from her economic distress will thus be excluded from contributing to her profits. In the chemical industry, too, which was her second great source of hope, conditions are similar."

Yes, all very true. But where would Canada have got off at had the hands that directed the systematic pillaging of Belgium, dictated the terms of peace?

German color makers are issuing their financial reports, and it is evident that their war-time prosperity is disappearing. The Badische Anilin und Sodafabrik declare a net profit of $2,720,000 as against $7,500,000 last year. With the aid of the amount brought forward, a dividend of 12 per cent. is paid. The capital is $22,500,000. The amount provided for depreciation is $10,150,000 as against $5,300,000 last year. The Farbenfabriken yorm. Fr. Bayer & Co., has a net profit of $3,020,000 as against $7,520,000 last year, and will pay a dividend of 12 per cent. The capital is $22,500,000. For each of the last three years these companies have paid dividends of 20 per cent. Kalle & Co. are paying 7 per cent. as against 10 per cent. last year. The present returns include substantial profits on munitions, so it appears that a period of stagnation is setting in.

The Canada Carbide Company, Limited

A Brief History of the Carbide Industry and a Description of its Growth and Development at Shawinigan Falls

By J. C. KING*

CARBIDE OF CALCIUM is usually kown to the general public under the name of "carbide," and for the sake of convenience is used under that term in this article.

Carbide, contrary to a quite popular belief, is not a natural mineral, that is mined like coal, or quarried like marble. It is a metallurgical product formed by the smelting together of lime and carbon in the intense heat of the electric furnace. In the smelting process these ingredients are reduced to a liquid state, elements other than the calcium of the lime and carbon of the coal being driven off in the form of gases, and leaving what is significantly called calcium carbide, which, upon cooling, forms a hard, dark-brown substance of crystalline structure, described chemically as CaC_2.

The process which takes place in the electric furnace is in accordance with the following chemical equation:

$$CaO+3C = CaC_2+CO$$

In practice the carbon monoxide, being nascent and chemically very active, picks up more oxygen from the air, forming carbon dioxide (CO_2). This is fortunate for the carbide industry, as the monoxide (CO) is a poisonous gas, while carbon dioxide is relatively harmless.

When carbide is brought into contact with water, immediate decomposition takes place, yielding a combustible gas known as acetylene, which is described chemically as C2 H2.

The Discovery of Acetylene.

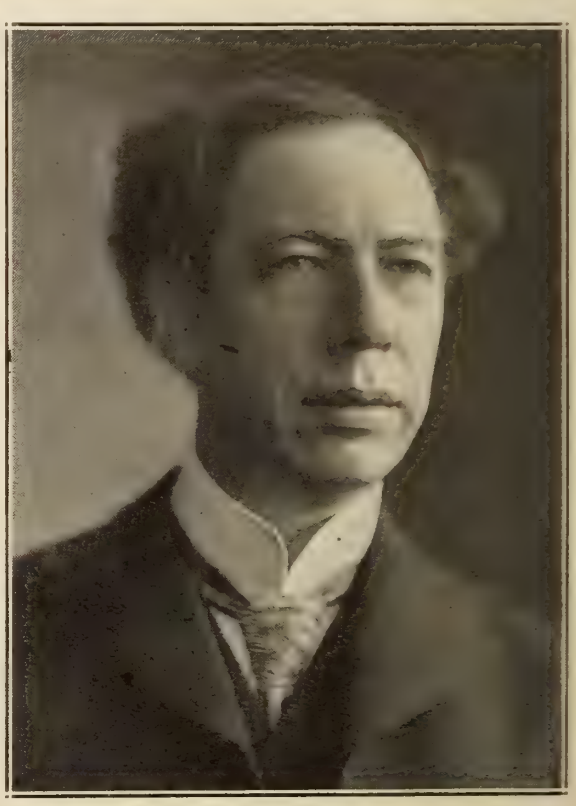
As early as 1836 Edmund Davy, an English chemist, observed that a by-product which he had secured incidentally to the production of metallic potassium, was capable of decomposing water with the evolution of a gas which contained acetylene.

In 1862 Woehler announced the discovery of the preparation of acetylene from calcium carbide, which he made by heating to a very high temperature, a mixture of charcoal with some alloy of zinc and calcium. The production of carbide by this method, however, was so tedious that for the next thirty years both carbide and acetylene were known to but few chemists, and to even these few, as only chemical curiosities. It is perfectly safe to say that up to 1892 no one even dreamed of the commercial possibilities of these chemical curiosities.

But the modern electric furnace was in course of development, and the high temperatures of the electric arc placed in the hands of investigators the means to enter hitherto unknown fields of chemical research. It was through the instrumentality of the electric furnace that the possibilities of carbide as a commercial product were revealed.

The Work of Willson.

Thomas L. Willson, an electrical engineer who was born in Woodstock, Canada, in 1861, conducted some laboratory electric furnace experiments in Jersey City, and obtained patents on processes for making aluminum, bronze, etc. In the year 1891 Major J. Turner Morehead organized a company known as the Willson Aluminum Company, and constructed a small plant at Spray, North Carolina, where he developed a water-power for the purpose. Mr. Willson moved to Spray, N.C., in the fall of 1891 to take charge of the operation of this plant for the manufacture of aluminum, bronze, and further experimental work in the electric furnace. One of the experiments undertaken by Mr. Willson was for the purpose of making metallic calcium, for which purpose he employed an improved Heroult electric furnace, with a current of 2,000 amperes and 36 volts, using a mixture composed of lime and coal tar, the volatile constituents of the tar being first driven off in an iron vessel. The resultant mixture of lime and carbon, after being treated in the electric furnace, secured for him a melted mass of dark color, which, on cooling, became a highly crystalline brittle mass. This material,



THOMAS L. WILLSON,
Founder of the Carbide Industries.

which turned out on investigation to be calcium carbide of high quality, was tapped out of the furnace, and a portion of the mass, while still hot, was dropped into a nearby pail of water for the purpose of testing it to determine if metallic calcium had been formed. To the astonishment of those present there was liberated a quantity of gas, which was ignited by the still glowing upper portion in the pail, burning with a smoky flame and giving off quantities of soot, which showed that it was not hydrogen, which would be liberated from metallic calcium and water, but a rich hydrocarbon gas. The experiment was many times repeated, and the product having been submitted

*General Manager, Canada Carbide Co.

to analysis, demonstrated that the solid substance was calcium carbide and the gas acetylene. On September 16th, 1892, a sample was sent to Lord Kelvin, in Glasgow, with a letter which has since become a famous document in scientific history, since it secures to Willson the honor of being the first to produce carbide on a scale large enough to promise commercial results.

In January, 1892, Mr. Willson began the operation of the works at Spray, N.C. During the spring and summer experimental work was carried on, covering many substances. His process for the manufacture of carbide showed the greatest promise. Mr. Willson and the Willson Aluminum Company disposed of their patents in the United States for the carbide process, and seeing the possibilities for the carbide and acetylene business, Mr. Willson, in the year 1896, organized the Willson Carbide and Acetylene Works of St. Catharines, Ontario, and built a works in Merritton, a nearby town, where he could obtain cheap water-power by constructing hydro-electric plants on the locks of the Welland Canal, his intentions being to supply the promising Canadian market and to produce large quantities of carbide for export to foreign countries.

The furnace used by Willson at Merritton is known as the old ingot type, the carbide building up in an ingot, or pig, of about 500 pounds weight on the hearth of the crucible. This furnace was of single phase, having a sinble suspended electrode, six inches by twelve inches by eighteen inches, carrying from 1,600 to 2,000 amperes at 75 volts, and one ton of carbide per day or seven per kilowatt day was considered a good yield.

New Furnace Types.

After his Merritton plant had been proven a commercial success, Willson licensed others who manufactured carbide at Ottawa, Ont., and Shawinigan Falls, Que. The Shawinigan Carbide Co. was established in 1904, and operated successfully on the same ingot type of furnace as was used in the Merritton plant until 1908, when a distinct step forward was made by the development of the single-phase-tapping furnace. In this new type the furnace was not shut down and allowed to cool so that the ingot might be removed, but the molten carbide was tapped out in much the same manner as iron from a blast furnace. It had one suspended electrode with one electrode buried in the hearth of the crucible.

This, in Canada, was the state of development to which the carbide furnace had attained when in June, 1911, the Canada Carbide Company, Limited, obtained from Willson all rights to manufacture carbide under his patents in Canada. They bought the various works outright, and are now operating under the original processes, which have been much improved from time to time.

When taken over by the Canada Carbide Company the single-phase furnaces were further improved by removing the buried electrode and suspending two electrodes in the crucible. This was a decided improvement, and logically led to the experiments conducted during the winter of 1912-13 on two-and three-phase furnaces. These experiments were more or less successful, and on the basis of the experience gained a three-phase 2,250 KVA unit, having three electrodes, was built and operated. This furnace showed a marked increased output of carbide per kilowatt hour. On the basis of this experiment a still larger unit was designed, and early in 1914 a three-phase 3,600 KVA furnace was built and operated very successfully. This furnace was also equipped with three electrodes, but on account of their sizes were built up in sections. But the demand was ever for larger furnaces, and in the summer of 1916 there was put into operation a three-phase 8,250 KVA unit, having electrodes built up of five pieces.

Let us pause here for a moment to compare this 1916 furnace with the original Willson furnace of twenty years earlier. The electrical input is twenty times that of its prototype, while it turns out forty times as much carbide in a day. The electrodes used are forty times as large as in the older type, and over twice as much carbide is produced per kilowatt day. Such is the improvement that twenty years has shown in the design and operation of carbide furnaces.

Recent War Developments.

In the meantime war had broken out in Europe, and soon practically the whole world was involved. A sudden

Tapping a Carbide Furnace at the Plant of the Canada Carbide Co.

General View Plant of Canada Carbide Co., Shawinigan Falls, Que.

demand was created for chemicals hitherto little used, and many of these, more likely than not, imported from Germany. Old sources of supply were no longer available, so new sources had to be found. Acetylene, an unsaturated hydrocarbon, was found to be a source from which many indispensable derivatives could be obtained but to get acetylene one must first have carbide, and all the carbide manufactured was insuffiicent to meet the ever-growing demands. Early in 1917, therefore, the Canada Carbide Company undertook the design and construction of a complete new plant, consisting of two 7,500 KVA units. This plant was successfully completed and operated by the Canada Carbide Company before the end of the year 1917.

The Canada Carbide Company's large extensions in size and number of electric furnaces very quickly showed to its management the necessity for considerable increase in all departments of the plant. To take care of these extensions appropriation of the necessary money was made, and during the years 1916, 1917 and 1918 the lime-kilns were extended so as to provide sufficient supply of lime for the work. Large storage capacity was provided for coke, which is obtained in ample quantities and of satisfactory grade from the Montreal Light, Heat & Power Company, in the city of Montreal. For the purpose of turning out better carbide and in suitable sizes for the markets of the world, the company extended their crushing, storage and packing departments, building an entirely new plant for the manufacture and finishing of carbide drums, and provided extensive warehouses for the storing and shipping of the finished product.

The business had expanded to such an extent that new office buildings, stores buildings, and welfare buildings for the employees had to be built.

Looking to the future development of the carbide business, the Canada Carbide Company investigated the sources of limestone supply in the nearby districts, and finally bought and opened up one of the best limestone properties in North America, giving them protection from shortage of this absolutely necessary raw material for many years to come.

The limestone is obtained nearby, coke only ninety-six miles away, and logs are taken from the nearby forests and sawed in the company's mill, from which crates for export packages are made. This places the Canada Carbide Company, located at Shawinigan Falls, in a unique position with reference to their raw materials. A satisfactory, intelligent and contented labor supply is obtainable locally from the French-Canadian people.

When, owing to requirements of the Canadian Electro Products Company for acetylene with which to produce chemicals, a hitherto unheard-of demand for acetylene was created, the Canada Carbide Company was faced with the serious problem of supplying this gas in quantities never before attempted. But the company was equal to the emergency, and in the summer of 1916 designed and constructed, and before the end of the year, put into operation an acetylene generating plant capable of delivering 600,000 cubic feet of gas per day. This capacity has since been doubled. Each of the generators takes half a ton at a single charge, and, when the occasion requires, may be charged every hour.

The Canada Carbide Company, Limited, of Montreal, operating plants at Shawinigan Falls, Que., and Merritton, Ont., is one of the largest manufacturers of calcium carbide in the world, having a capacity of two hundred tons per day. Carbide has been manufactured in some of its plants continuously for the past twenty-three years. During this time the enormous advance in consumption of carbide has made necessary repeated improvements and additions to the capacity of the company's plants. For several years, however, the company has made, and for the future will make, adequate provision to meet the steadily increasing demands, both domestic and foreign.

Such is the history of the growth of the carbide furnaces and processes from the single-phase, single electrode ingot type, built by Thos. L. Willson, to the great three-phase, three-electrode tapping furnace of to-day, as operated by the Canada Carbide Company, and the carbide industry is now a highly scientific business, conducted on broad and sound principles.

CHEMICAL SCHOOL AT CAMBRIDGE.

Leading oil companies and capitalists of Great Britain have agreed to supply funds, amounting to $1,050,000, for the purpose of establishing a chemical school at Cambridge University, England. A geoditic and geodynamic department will also be established at Cambridge.

IMPRESSIONS OF SHAWINIGAN

By JOHN S. BATES

THE summer of 1915 was marked for many of us by a first real acquaintance with acetone. So pressing was the need for this cordite solvent that tradition was thrown to the winds in the quest for the noble liquid which the British War Office must have. The story of acetone through the war unfolded like a romance, and had a fascination such as few other war materials could offer. From the single method of hardwood distillation there sprang new and ingenious processes whereby acetone was won from such widely-separated raw materials as calcium carbide, molasses, corn, kelp, and spent soda pulp liquor.

The first seeds of war demands fell on fertile soil in Montreal. It was not long before the Shawinigan officials pictured their rock-like calcium carbide turning into acetylene gas, converting to acetaldehyde in some mysterious way, becoming more familiar again as acetic acid, and flowing out as pure, clear acetone. The picture appeared so unusual that technical men were at first inclined to be skeptical, but the Shawinigan Company had certain men of tenacious spirit, who pressed for a trial.

It was December, 1915, when the first group of chemists started on their great adventure in a dusty corner of the carbide plant at Shawinigan. On a bitterly cold night in February a party arrived in Shawinigan, after the minor disturbance of a train wreck, to visit the workshop from which promising reports were issuing. A view of the homely apparatus, and the grimy but confident faces of the research group, was enough to convince everyone that acetone was going to be made at Shawinigan.

In May, 1916, an acetone contract was signed by the Shawinigan Water and Power Company on behalf of the newly-formed Canadian Electro Products Company, Limited, and the Imperial Munitions Board, acting for the British War Office. Even at that stage it was a daring step on the part of the company. It may safely be said that only enthusiastic patriotism on the part of the com-

Some Directors of Shawinigan Industries.

pany's higher officials made the undertaking possible, as the problems were manifold and the financial prospects nothing more than a bare recovery of investment—provided the processes turned out all right. As a matter of fact, the commercial proposition, as carried out during the first year, never became attractive financially from the acetone standpoint, but soon appeared as a simpler and more logical acetic acid process, with far-reaching possibilities for the future.

In September, 1916, the writer had the privilege of taking up regular duties at Shawinigan as technical representative of the Imperial Munitions Board at the new plant, and for over two years shared in the triumphs and tribulations which marked the progress of events. It is not necessary to go into details. Suffice to say that the process was a success from the standpoint of meeting war demands. The pace was too fast and the processes too new and complicated for piling up large war profits, but the company had the satisfaction of making deliveries in time of need, and establishing in Canada an industry based on organic chemistry, that should have great significance in the years ahead. This is an important distinction from most munitions plants that pass with the ending of the war.

It was rather unusual to see the planning and operation of a plant largely in the hands of young chemists and engineers with limited practical experience. True, they made blunders, and at times tried the patience of "practical" men. And yet the technical men were the only ones who could be expected to carry such an undertaking through to a successful issue. There was no cloud of tradition to dim the enthusiasm of the staff, and no "it can't be done" ammunition at hand. One could not help wishing that the same freedom from custom might have more sway in older and better-established industries.

Chemistry holds the key to the essential workings of a process where matter is changed from one kind to another. Once the key is found by research, a chemical process becomes mainly a mechanical problem. Design of apparatus must be based on an analysis of the factors which govern the operation. Materials of construction loom large in the working of a plant, and one realizes how varied are the requirements for special materials to meet the conditions of corrosion, pressure and temperature in modern industry. The Shawinigan plant, for instance, made wide use of high-silicon iron, silver plating, asphalt, treated concrete, aluminum, copper, bronze and treated wood.

When the plant was ready to handle the half-dozen or more new processes, it was surprising to see so many familiar types of machines and apparatus. Although special designs were used to a considerable extent, the standard apparatus of chemical and mechanical engineering catalogs was well represented. This is another argument for looking on chemical engineering practice as a series of typical operations quite limited in number. The chemistry of the plant was new to commerce. The operations of manufacture were electrolysis, filtering, settling, distillation, pumping, dissolving, boiling, just as in hundreds of other plants.

No new plant of this kind continues to run on the same basis as planned and built. At Shawinigan there was a constant meeting of troubles and solving of difficulties. The Shawinigan organization showed power of decision and promptness of action, without which the undertaking would have slipped to failure. The faith of the company was in evidence throughout, and there were many occasions for recognizing character in an organization as well as in an individual.

In this connection a word regarding the Imperial Munitions Board may not be amiss. The Board's policy was one of continual assistance to the companies supplying war materials and appreciation of their efforts. Too few realize what a tremendous work the Board accomplished for Canada and for all the allies in a quiet, businesslike way, with a temporary organization welded together by a strong, common purpose.

Rapid change was the order in Shawinigan during the war. New plants came into being in quick succession. The result is a most interesting array of specialized industries for the production of calcium carbide, carbon electrodes, magnesium, aluminum, carborundum, aloxite, silicon, ferrosilicon, Prestolite gas, electric steel, cotton, pulp and paper, lumber, as well as acetic acid, acetaldehyde, mercuric oxide and other chemicals. Anyone familiar with technical matters can easily see the further possibilities with this combination as a start. Less appreciated, but no less interesting, are the waste products which flow to the river or which escape to the air. Carbon monoxide, nitrogen, lime sludge, chlorine, waste sulphite liquor and other products are now receiving attention, and may yet result in further links to the industrial chain. The prospects for Shawinigan are bright. Growth depends to a large extent upon research, which is being continued with fresh activity. Export trade is a necessity for most of the industries, as Canada consumes so little in the way of electro-chemical products. The plants under the control of the Shawinigan Water and Power Company, and the various others which are located in Shawinigan to use the power from the falls, have played a much larger part in the war than most people realize. There is every reason for hoping that the industries may expand in the future to share in the peace-time demands of the world's markets.

Shawinigan itself is richly endowed by Nature. It would be hard to find a water-power of such size that is so simple of development, and this, of course, is the secret of the industrial success. The natural beauty of the original town site must have been most pleasing. The treatment which it has received at the hand of man is another story. By the acid test of willingness on the part of officials to live there the town has not yet been made attractive as a place of abode, but it is to be expected that time and effort will bring the town up to the high standard of its industrial workshops. The fairly central location of Shawinigan adds to the promise for the future.

Anyone who has once come into contact with the developments of Shawinigan and district is impressed with their size and scope. Comparatively little has been told of this industrial centre in the past. The future should hold great things in store for Shawinigan.

UTILIZATION OF FISH WASTE.

Great progress has been made in recent years in the United States in the utilization of fish waste and waste fish for the recovery of oil, stock and poultry food, fertilizers, etc. The amount of fish meal produced in California alone in 1918 was 12,678,000 lb., and 350,000 gallons of fish oil. In Canada the Honorory Council for Scientific and Industrial Research has conducted investigations into the industry with a view to its further development in the Dominion.

What Canadian Chemists at Shawinigan Falls Have Done to Win the War

The record of personal achievement that grew out of work done under great stress in connection with the building up of chemical and metallurgical industries at Shawinigan Falls, Quebec.

By A. F. CADENHEAD*

ABOUT the end of April I was requested by the Chairman of the Canadian section of the Society of Chemical Indutsry, to prepare a paper dealing with the war activities of Canadian chemists at Shawinigan Falls. With scarcely two weeks at my disposal, I must beg for your indulgence toward the inadequacy of this paper to do justice to the facts in the necessarily brief survey of the chemical activities in this locality which time permits.

I find myself in rather a delicate position in undertaking this task. In the first place, the interests of the corporation with which I was connected there, must be respected, and to do this it is necessary to sacrifice a certain amount of detail regarding processes, results, and so forth, which is, naturally, of interest. Secondly, the situation holds difficulties for one who has been through the work there almost from its commencement, which I trust you will appreciate, and for which you will make allowances.

The tremendous possibilities for the development of electrical power in and around Shawinigan Falls are well known. They constitute the basal asset of that district. With a maintainable working hydrostatic head of 145 feet, and a large volume of water in the town itself, and two other falls within a radius of six miles, one of which yet remains undeveloped, the locality is virtually a second Niagara, and is fast becoming the electro-chemical centre of North America. Circumstances thus made Shawinigan Falls a big asset from the standpoint of the manufacture of munitions of war; nor were the companies controlling it slow to make this asset available to the Canadian War Mission. The rapidity with which big development followed big development there, is a favorable commentary upon both the insight of the war boards, and the patriotism of our Canadian industrial organizations.

New Industries.

Dealing first with those industries which sprang up almost over night, due directly to the war, I would like to speak of the splendid work done by the Canadian Electro-Metals Company—a subsidiary of the Shawinigan Water and Power Co. Here, the urgent demand for metallic magnesium was responded to by the development and perfection inside of four months of what is probably the most economic process for the production, in commercial quantities, of metallic magnesium.

Experimental work was started in April or May, 1915, in a small shack on the hill above the power-house. Here, in this short time, the many difficult problems confronting such a task were met and solved, and in May, 1916, construction was completed on a plant in the industrial section of the town, capable of producing 700 to 800 pounds per day of metallic magnesium, and actual production on the large scale began, in the latter part of the month. The form in which this material was largely required, was powder for flares, star shells and tracer bullets, etc., of which vast quantities were used at the front. The problem of powdering large quantities of magnesium turned out to be no small one, but this, too, was solved, and excellent grades of magnesium powder 200—150, 100 mesh and lower, 99.5 to 99.9 per cent. pure, were produced, and shipped overseas. At my request this company very generously, at their own expense, shipped samples of this powder of varying mesh to France, to Capt. W. M. Goodwin, M.C., of the Canadian Engineers, son of our honored chairman, for experimental purposes, and I may say that they were put to very excellent use.

This work throughout its experimental stage, and until the large plant was operating smoothly, was in charge of a Canadian chemist and metallurgist, a native Canadian, and a graduate of one of our Canadian universities. This man, when the new plant was running smoothly, resigned his position as superintendent, and went overseas with the Canadian Forces.

The Prestolite Company erected a small plant near the Canada Carbide Company in 1917, and bought acetylene gas from them. Had they at that time been able to obtain their solvent, acetone, from the Electro Products, a scant half-mile away, they would have been completely supplied with all raw materials on the spot without transportation charges. But all our acetone was going overseas.

The Canadian Aloxite Company, Ltd., in 1917 erected a plant costing in the neighborhood of one million dollars. Their chief article of manufacture is carborundum, or carbide of silicon. Carborundum is probably the best known of the artificial abrasives, and naturally was used to a great extent, both directly and indirectly, for war purposes. They also turned out a considerable amount of high-grade silicon—a ferro-silicon containing 75 to 90 per cent. silicon. This was used, I am told, in producing hydrogen for balloons at the front. In peace times it is used mostly in the production of transformer and other high-grade steels. This concern employs now about 125 men, and their business, both in the abrasive and high-grade silicon field is back to a peace basis. They have their own analytical laboratory and chemist on the plant.

The Canadian Ferro-Alloys, a subsidiary of the Ludlum Steel Corporation of New York, erected a plant and one furnace later in the year 1917, and early in 1918 were producing a 50 per cent. ferro-silicon. An interesting point in connection with this plant is its use of 3 phase, 60 cycle current in an open bath furnace. This was a radical departure in electric furnace practice, which has been rewarded with success. Three other large furnaces of a similar type are now operating at Shawinigan.

The extraordinary adaptability and flexibility of the electric furnace in changing abruptly from one product to another, is a point which strikes one forcibly.

Other industrial concerns which were operating in Shawinigan Falls before the commencement of the war are: The Belgo-Canadian Pulp and Paper Co., and The Northern Aluminum Co., which is the Canadian branch of The Aluminum Co. of America, and manufactures metallic

* Paper delivered at Second Convention of Canadian Chemists, Montreal, May, 1919.

aluminum and aluminum wire and cable, the latter chiefly for transmission lines. Both the above concerns have well-equipped laboratories and employ staffs of chemists at their plants.

The Shawinigan Cotton Company also have a large plant at the C.P.R. station, in the centre of the town, where scarcely a decade ago, as photographs show, the land was covered with tall trees.

Development of Synthetic Acetic Acid.

But possibly the most interesting development at Shawinigan Falls, is the synthetic acid and acetone plant of The Canadian Electro Products Co., another subsidiary of The Shawinigan Water & Power Co.

During the summer of 1915 the demand for acetone for the manufacture of cordite, the propulsive charge used in the British Army, became so insistent that the possibilities in every source of acetone were investigated to the last detail. The producers of acetone at that time, practically all operating by means of the calcium acetate process, and working to capacity, were quite unable to even approximate the demand. It was one of the big problems the Munitions Boards had to solve and solve quickly. Many expedients were resorted to. A huge plant for producing acetic acid by making vinegar out of molasses was put up in the United States. In California the kelp industry sprang into sudden active life, and another large plant was built out there to produce acetone, among other things, from kelp. The British Acetones, Ltd., making use of an idle brewery in Toronto, began to produce acetone from corn syrup by a fermentation process using the bacillus macerens.

In the fall of 1915, among the first, the Shawinigan Water and Power Company went into the game. They decided to try out the synthetic process for making acetic acid and acetone, from acetylene gas—or to go back the remaining two steps from calcium carbide—from limestone and coke. Such a process could only be operated in the vicinity of a carbide plant, and the company already had a large plant—the Canada Carbide Co., in Shawinigan Falls—where three ten-ton furnaces had been in operation for a number of years.

The services of Mr. H. W. Matheson, a Canadian and a graduate of one of our Canadian universities, at that time with Du Pont Powder Co., were obtained, and in December, 1915, experimental work on a commercial scale was started in a small building under the grim, dusty walls of the Canada Carbide Co.'s plant at Shawinigan. The difficulties of designing and obtaining the special equipment suitable to the work, took time. By the end of May, 1916, there were five Canadian chemists at work there. All five had obtained their training in and were graduates of Canadian universities.

The romance of the ensuing five or six months of intensive research work on this process will always be fresh in the minds of those whose privilege it was to be connected with it.

This process naturally divides itself into three sections. First, the conversion of acetylene gas into acetaldehyde. Second, the oxidation of acetaldehyde to acetic acid. Thirdly, the conversion of acetic acid directly into acetone. These were known as processes one, two, three, respectively. There was a fourth process, which was the preparation of the catalyst used in large quantities in process one.

The reactions are, without exception, catalytic, and a great many catalysts were tried before those most suitable were selected. One man was assigned, initially, to each process. The fifth was "The Boss." This organization worked in complete harmony, and was so enabled to produce results.

This meant work, and when we went there, some of us were actually under the impression that we had done hard work before. This work lasted week-days, holidays and Sundays; sometimes all day and all night, home for breakfast, and a smoke, and all the next day. Or what was worse, being called out at two a.m. to take the temperature or feel the pulse of one of the processes. I think there is only one thing that may lawfully get a man out of bed in the middle of the night without making him mad, and that is to go fishing. But we had no time for fishing that summer.

There were four processes involved, and we were often inclined to endow certain of these processes with sullen intelligences of their own. Trying to keep track of process two was as bad in those days as trying to locate a German "typewriter" from a front line trench. If we did not have at least two explosions a week we began to feel badly and think the game was losing pep. We became actually jumpy—and in the wee sma' hours of the dog watch if someone dropped a pipe wrench behind us, or made any other unusual noise, we were apt to go up in the air, mentally at least.

However, by the end of September we had won the confidence of these reactions, and they were, figuratively speaking, eating out of our hands. Things were going smoothly and everyone was happy—and when we moved into the new plant in October, we were glad to get away from the everlasting dust cloud around the carbide.

On the first of May, 1916, long before the completion of the experimental work, such was the urgency of the situation, the bush was being cleared from the site of the large plant some one-half mile away, and it was well toward the end of the month before actual construction was begun on any of the buildings.

By the first of October process four was operating on the large scale. Before the end of the month process one was under way, and on November 20th, 1916, our first batch of five tons of acetic acid was produced. During January, 1917, the first carload of 17 tons of British War Office Specifications C. P. triple X Acetone left the yards, and cigars were passed around (outside the plant).

A Record of Difficulties Overcome.

Mr. Chairman and gentlemen, without any desire to boast, I wish to make the simple assertion that this signified a mechanical and chemical achievement.

In less than nine months there had been accomplished a most complex and difficult piece of work, which, in ordinary peace times would have required at least four to five years for its consummation.

I have said little of the mechanical difficulties. They were, if anything, more numerous than the chemical, for they were subject to them, and great credit is due the staff of engineers who designed and had constructed amid great difficulties, due to the congested state of their various sources of supply, the apparatus and equipment which was demanded of them. The plant was designed to produce ten tons of acetone daily. As the production of a pound of acetone means the using up to 2.3 pounds of acetic acid, approximately, this meant a capacity of 25 tons of acetic acid daily. Going back further, this meant some 50 tons of carbide was required daily, and a new 50-ton carbide furnace had to be designed and installed at the Carbide to take care of this, so as not to interefere

with the British War Office contracts for carbide of calcium. It is worthy of note that the peace time trade of this concern, of necessity, suffered under these conditions.

Did time permit, I would like to give you instances of some of our troubles—for we had many of them. How the presence of phosphorus in the coke and limestone gave us a great deal of trouble by introducing phosphides into the carbide, which in turn got into the acetylene as phosphine—which proved to be a catalytic poison.

I must not omit to tell you how one of our ablest chemists, in a period of what we may call intense mental concentration, lit a match to see how much aldehyde remained in a container—and came out of his dream minus his eyebrows and front hair. This was in the early experimental days. We made many mistakes, being only human, but we all came out of it safely.

There were turned out at this plant and shipped overseas twelve hundred long tons of acetone. In the fall of 1917, the demand for acetic acid for use in the production of cellulose acetate for coating aeroplane wings, became very great due to the tremendous aerial developments at this time. The plant was, therefore, used to produce acetic acid only, and until the time of the signing of the Armistice, had produced and shipped in the neighborhood of 10,000 long tons of this material. This in a period of less than a year.

The United States Plant.

When the United States entered the war, the demand for acetic acid was more than doubled. The United States was compelled to turn to Canada for her adequate supply of this war necessity, and in March of 1918, in six feet of snow, construction was begun upon a duplicate of the plant of the C. Electro Products, adjacent to it, and which was known as The American Electro Products. The Armistice was signed before production was begun in this plant.

These two combined plants, representing an outlay of more than $4,000,000, and those other plants erected to supply war needs, remain not alone a monument to the part that Canadian chemical industry played in the war, but, what is more important, are a real asset to this industry. Their work is only starting, for new they are free to take up and develop link by link the great chain of chemical products and materials that are to be derived directly from these sources, and which, we are confident, will assist in making Canada a prominent factor in the world of industrial chemistry.

A record of past achievements is only of value if it can be made use of in the present, or serve as a sure guide to the future—and this paper would be of little value were it to end with a record of what has been done. Without taking time to go into details, I may say that the many industries in Shawinigan Falls are already on a peace basis, and looking forward with every confidence to the new conditions. The old-established concerns are as busy as ever, and the newer ones are fast adjusting themselves to peace-time needs, while all are actively engaged in seeking new fields to conquer.

Future Research.

Since the first of the year, The Shawinigan Laboratories, Ltd., has been reorganized, as an independent concern, which is really the research bureau of the Shawinigan Water and Power Co., and an encouraging number of research chemists and metallurgists are engaged upon new problems. The manufacturers of magnesium are entering the alloy market, and have made some remarkable advances. The possibilities in cheap magnesium tax the imagination.

The Acetic Acid Plant, which has already made important steps in that direction, is preparing to enter further into the field of pharmaceutical chemistry. Indeed, the possibilities before them in all fields are really too numerous to mention. Acetic anhydride, acetone oils, metallic acetates, chloroform, paraldehyde, ethyl alcohol, are only a few that occur to me in passing.

One of the by-products from process two is some fifteen to eighteen hundred cubic feet of free nitrogen per minute, as the oxidation of the acetaldehyde is effected by simply blowing air through it, in the presence of a catalyst. This nitrogen is available for fixation by the new sodium carbonate fixation process, and will undoubtedly be utilized in time.

These isolated facts are related to show some few of the possibilities lying before what I believe will prove to be one of our basic chemical industries.

In presenting this very casual survey of what Canadian chemists have done for the war in Shawinigan Falls, and which has undoubtedly been equalled all over the Dominion, I wish to emphasize that while we are merely beginning our career as a commercial nation from the chemical standpoint we have an excellent start.

There remains much to be done by Canadian chemists and metallurgists, and we are none too numerous. There is a wonderful field before us, and it awaits development at our hands.

POTASH INDUSTRY IN ENGLAND.

The presence of potash in the dust from blast furnaces was known as far back as 1878, and systematic efforts have been made to recover it. As much as 30 kg. of potassium carbonate can be recovered per 10,000 cubic metres of gas. This is obtained by dry purification of the gas and volatilization of the alkali as chloride by the addition of sodium chloride. The proportion of potash to soda volatilized as chlorides is fairly constant, varying from 85:15 to 90:10. By this process, potassium chloride may be produced at a lower price than the German potash delivered in England before the war. The blast furnaces at present in operation could supply supply 400 to 500 tons of KCl a week, and could also supply the most pressing needs of the country for 99 per cent. potassium carbonate, 90.5 per cent. bicarbonate, 99.8 per cent. potassium ferrocyanide, and 99.8 per cent. potassium permanganate. Other sources of potash are the dust from cement kilns, and wool-grease. Research is being carried on along both these lines, but the cost of recovery from cement kilns is higher than that from blast furnaces. The Ashcroft process, which consists in heating to a high temperature potash-bearing rocks in the presence of sodium chloride, gave yields up to 85 per cent. of the potash present, and the cost of production before the war was lower than the price of German potash.

This is what President Wilson has to say of the relation of the chemical industries to the problem of national defence: "Although the United States will gladly and unhesitatingly join in the program of international disarmament, it will, nevertheless, be a policy of obvious prudence to make certain of the successful maintenance of the many strong and well-equipped chemical plants."

The Production of Electrodes by the Canadian Electrode Co.

By G. H. SPENCER*

THE function of the electrode is to carry electric energy from the conductor to the point of application. In the case of the electric furnace this means from the bus bar into the furnace charge, where it is converted into heat. As the electrodes are the only avenue through which current is introduced into the furnace, it is obviously important that they neither contaminate the charge nor cause undue waste of energy. Electrodes are made of many materials and in many sizes and shapes to meet the various requirements of present-day electric furnace conditions, but certain essential properties are common to all. An electrode should possess high electrical and low thermal conductivity; it should also possess the mechanical strength to withstand considerable handling, as well as great temperature changes, without danger of breakage.

Varieties of Electrodes.

Electrodes may be considered under three general classes: (1) Metallic, (2) graphite, and (3) amorphous carbon.

(1) Metallic electrodes are now rarely used, and then only in special furnaces, usually of small dimensions, and which are operated at either very high or very low voltages.

(2) Graphite electrodes are much more widely used, especially where the current densities required are relatively high, the electrical conductivity of graphite being usually taken as about four times that of carbon. Graphite is also more resistant to chemical action, and, in particular, to atmospheric oxidization than is carbon, beginning to oxidize at a temperature of about 640° C. as compared with 500° C. in the case of carbon. On the other hand, it has been shown to be impracticable to make graphite electrodes of as large cross-section as is possible with carbon. It is in the electro-chemical field, therefore, requiring small electrodes, highly resistant to chemical action and of high electrical conductivity and tensile strength, that graphite is most widely used. Graphite electrodes are made of amorphous carbon, finely pulverized, mixed with a binder extruded from a press and baked, then artificially graphitized in an electric furnace.

(3) Amorphous carbon represents the great bulk of the weight of furnace electrodes manufactured. The superiority of graphite over carbon, as mentioned above, is more apparent than real. To offset the higher electrical conductivity of graphite, amorphous carbon shows a lower thermal conductivity. The higher tensile strength of graphite is more than counterbalanced by the practicability of making amorphous carbon electrodes of several times larger cross-section; while the greater resistivity to chemical action shown by graphite electrodes cannot compensate for the difference in price of these as compared to amorphous carbon electrodes. Each, in a general way, has its own particular advantages: graphite in the field of electro-chemistry, and amorphous carbon in that of electro-metallurgy.

Production at Shawinigan.

The Great War created unusual demands for electrodes, and especially for those large amorphous carbon electrodes used in the manufacture of electric steel, carbide, ferro-alloys, silicon, etc. At first the existing stocks of electrodes were drawn upon, but when these had been exhausted a serious shortage faced the electro-metallurgical industry. By the spring of 1916 the large electric furnaces of the country were in the precarious position of living from hand

*Superintendent, Canadian Electrode Co.

General View Plant of Canadian Electrode Co., Shawinigan Falls, Que.

to mouth, so far as electrodes were concerned, and current furnace requirements far exceeded the total capacities of existing electrode plants to meet these demands. This, then, was the situation in the second year of the war, when the Shawinigan Water & Power Company, of Montreal, with characteristic foresight and courage, financed the establishment of a plant for the manufacture of large amorphous carbon electrodes at Shawinigan Falls, Quebec. Construction was commenced in the early spring of 1916 by the Construction Department of the Shawinigan Water & Power Company on a steel and brick building, 166 feet by 51 feet. This building housed the transformers, calcining furnace, coal bins, crushing and grinding machinery, mixer, tamping machine, three baking ovens, and the works office of the Canadian Electrode Company, Limited.

In November, 1916, the first experimental electrode was tamped, and in December the first finished electrodes taken from Oven No. 1. During January, 1917, three bakings of a total weight of 38 tons were produced, and steady operation of the plant was an assured fact. From this beginning, electrode production has steadily increased, the month of December, 1918, showing an output of ten times the tonnage produced in January, 1917. In August, 1917, Oven No. 4 was built to take care of increased production, and in April, 1918, construction was begun on a new steel and brick building, abutting the old one at right angles

During 1917 production was limited to 16-inch by 16-inch electrodes, about seven feet long and weighing about 1,200 pounds each, but in December of that year a start was made in the manufacture of 17-inch diameter electrodes, for use in steel furnaces, and such progress was made during the next two months that in March, 1918, the Imperial Munitions Board requested the enlargement of the plant to supply British Forgings, Limited, of Toronto. On April 21, 1918, construction of this extension was begun, and on July 20, exactly ninety days later, the first electrode was tamped in the new building.

Designed to quadruple the production of the original plant, this addition has more than fulfilled expectations; so much so, in fact, that the enlarged works is now capable of producing six hundred tons per month of finished electrodes. Some idea may be gained of the enormous growth during the war of the electric furnace industry when it is recalled that the total electrode consumption in Canada for the year 1914 was somewhat less than the tonnage used at Shawinigan Falls alone during 1918, and about one-third the present capacity of the Canadian Electrode Company's plant.

What more logical place to locate an electrode works than in this hydro-electric centre? Among the local users of amorphous carbon electrode may be mentioned the Canada Carbide Company, Limited, who make calcium carbide and acetylene; the Canadian Aloxite Company, Limited, manufacturers of silicon, carborundum and aloxite, and the Canadian Ferro-Alloys, Limited, who have specialized on all grades of ferro-silicon, but who are also equipped to manufacture many other ferro-alloys, all of whom use 16-inch by 16-inch electrodes; and Fraser Brace & Company, who use 17-inch diameter electrodes in the manufacture of high-grade pig-iron and electric steel.

Indeed, the advantage to be offered in the way of excellent transportation facilities over both Canadian National and Canadian Pacific Railways; abundance of cheap electric power, and proximity of an electrode works capable of meeting all needs, manifestly destine Shawinigan Falls to become one of the largest centres, if not the largest electro-chemical and electro-metallurgical centre, in North America.

PHILADELPHIA TO GREET AMERICAN CHEMISTS.

Owing to the great advances made by American chemistry as a result of the European war, the fifty-eighth meeting of the American Chemical Society to be held in Philadelphia from September 2nd to 6th inclusive, will be undoubtedly the largest ever held by that organization. The membership, which has increased nearly two-fold since 1914, is now 13,600, and is being augmented every month. The sessions, which are to be held at the Bellevue-Stratford, will touch upon problems of reconstruction growing out of developments which placed the American chemist so much on his own resources both for materials and apparatus with the closing of foreign markets.

One of the features of the meeting will be the first session of the newly organized dye section. There will be a joint session of this section with the Division of Industrial Chemists and Industrial Engineers to consider a proposal to revise the patent laws. It has been suggested the charging of nominal annual renewal fees would compel many patentees to work their patents rather than to permit them to be idle for many years.

Special arrangements have been made to give to all delegates access to the chemical plants of Philadelphia. There will also be an excursion on the Delaware River which will give them the opportunity of viewing the munition works erected in that region. The conversion of such establishments to the ways of peaceful industry will come up in various aspects before divisions of the Society. The provisional program is as follows: September 2nd, Council meeting and dinner to Council, tendered by the Philadelphia Section; September 3rd, general meeting with addresses by Newton B. Baker and other distinguished speakers, followed by the divisional meetings; September 4th, divisional meetings and president's address, by Dr. William H. Nichols, at the Museum of the University of Pennsylvania; September 5th, divisional meetings and banquet in the evening at Bellevue-Stratford, the program to conclude on the sixth with excursions and automobile trip to Valley Forge.

NEW MEXICAN OIL FIELD.

Recent investigations which have been made on the Pacific Coast reveal the existence of rich deposits of petroleum. These discoveries, it is stated, are of great importance, because they will ultimately serve to intensify maritime traffic, and seem to presage for some of the western ports of Mexico a future as promising as that of Tampico or Tuxpam. The Mexican Government, through the Department of Industry, Commerce and Labor, has conceded authority to explore and exploit the island of Altamuro, located in front of the port of Altata. In 1917, when the President made his tour of the western part of the Republic, the present concessionaire conferred with him in Guadalajara, and on that occasion expressed the belief that the Pacific Coast of Mexico was rich in petroliferous deposits. As a consequence, he was authorized later to make a thorough investigation. In his recent explorations the concessionaire discovered that the island is extraordinarily rich in asphalt and oil deposits. The vegetation has almost entirely disappeared, and there are innumerable pools of oil on the surface of the ground.

General Remarks on the Metallography of Pure Metals

By G. O. MORRISON*

When a properly prepared sample of a pure metal is examined under the microscope, a network of closed figures with straight sides is observed. Each mesh of this network represents a section through a solid bounded by plane faces.

When a substance passes from the liquid to the solid state, the process of solidification is generally accompanied by crystallization; that is, the molecules of the substance arrange themselves to form small solids of regular outlines, such as cubes, etc. Each of these regular bodies is called a crystal, and substances made up of crystals are crystalline. Solid substances, which are not crystalline, are amorphous, e.g. glass.

Occasionally, when conditions are such that the formation and growth of crystals are given free play, perfect crystals are formed. More often, however, less favorable conditions, such as contact with other crystals also forming, cause the formation of crystals in which the regular form is not preserved; these are crystalline grains. This condition affects only the external shape and not the crystalline character of the substance.

Metals on solidifying generally give rise to crystalline grains. The explanation is that crystallization sets in at many centres. From each of these centres the crystal grows thin successive additions of similarly orientated crystalline matter, until, meeting other crystal growths radiating from adjacent centres, the free development of its external form is arrested. Therefore, the network one sees on examining pure metals does not represent the outlines of true crystals, but rather junction lines between adjacent crystalline grains.

The number of crystlline growths in a certain mass of metal depends therefore on the number of centres at which crystallization sets in, and this depends on the metal itself, its rate of cooling and its purity. In other words, the slower its solidification and the greater its purity, the fewer the centres and, therefore, the larger the crystalline growths.

The Microscope View.

To make the network visible under the microscope, the properly polished surface must generally be acted upon by a reagent capable of dissolving the metal, and sometimes depositing a film on it. Under vertical illumination the short surfaces which lie between the crystal grains appear black, because they do not reflect the light back into the microscope. A heavier etching imparts different colorations to the various crystalline grains, due to a constant orientation in the individual grain, and a change in orientation in surrounding grains. Still deeper etching frequently brings out pits within each mesh of the network. These pits have distinct geometrical forms, such as cubes, and are a true indication of the system in which the metal crystallizes.

The boundaries between growths in a crystallized metal may be narrow spaces filled with amorphous metal, which holds the growth together. This latter view is supported by the fact that where differently orientated crystals meet, there must be a region where the intervening metal cannot assume the orientation of either. This amorphous crystalline cement accounts for the greater strength and toughness of a fine-grained structure, seeing that it must contain a greater quantity of strong amorphous cement.

When prepared samples of metal are strained to the yield point and examined, black lines are seen to cross the crystalline grains. These lines are straight and parallel in the same grain, but have different directions in different grains. As the strain is increased, other systems of lines, inclined to the first, appear. These lines are not cracks, but steps in the surface due to slips along the gliding planes of the crystals.

In annealed metals we very frequently find numerous twin crystals; that is, crystals that are symmetrical to each other with respect to a plane between them, which is not a plane of symmetry.

The effect of severe mechanical treatment, such as rolling, drawing, forging, etc., on the structure, and, therefore, the properties of metals, is to make the final grain size smaller by breaking up or distorting the existing grains. A smaller grain generally means greater strength, and in some cases, greater ductility.

Results of Treatment and Impurities.

The size of the crystalline grains in pure metals varies in different metals, even when cast and cooled under identical conditions. Their dimensions are also affected by the rate of cooling during solidification—hence by the size and nature of the casting. On annealing the grain size of a pure metal will not increase unless it has been previously strained. Some evidence is also present to show that it must, in addition, contain eutectic forming impurities.

The addition of small amounts of foreign substances as impurities often affect, very greatly, some of the most important properties of metals, e.g. strength, ductility, fusibility, etc., and we expect corresponding changes in structure. By impurity we mean a very small proportion of some foreign substance, which may be a metal, metalloid or definite compound. This impurity may do two things: (1) it may remain uncombined, or (2) it may combine with some of the metal to form a definite chemical compound. The uncombined impurity may then be soluble in the solid metal forming a solid solution, or be insoluble in the metal and be rejected by the grains in the form of an eutectic alloy.

Those impurities which form solid solutions have very little influence on the structure of the metal. Suitable prepared sections still show the same network as the pure metal, but with this difference, that the grains are now imperfect crystals of a solid solution instead of the pure metal. While the character of the structure remains the same, the size of the grains may be much affected.

Those impurities which do not form solid solutions, whether they combine or not, are usually readily detected, as they are generaly rejected to the grain boundaries during solidification. These insoluble impurities unite mechanically with a small amount of the metal to form an eutectic alloy; that is, an alloy of lowest melting point, and it is this alloy which is expelled by the solidifying grains. The presence of membranes of this type, whether continuous or not, has a very great influence upon the properties of the metals, generally decreasing their ductility, conductivity, etc., and increasing their hardness, fusibility, etc.

The above remarks refer more especially to the behavior of impurities while the metal solidifies. In most cases no further changes occur as the metal cools to atmospheric temperature. In some cases, however, important changes do occur at temperatures considerably below the solidification point.

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The Manufacture of Aluminum at Shawinigan Falls

ONE of the earliest applications of the power developed at Shawinigan Falls was for the manufacture of aluminum. The first works were built in 1900 by the Northern Aluminum Company, Ltd., a corporation formed to manufacture aluminum in Canada, and numerous additions have been made to the plant at various times since, so that the aluminum industry, which was one of the earliest to make use of the power at Shawinigan Falls, is now, and always has been, one of the largest consumers of power produced there.

The production of aluminum by the electrolytic reduction of the oxide of the metal requires continuous current. The principal portion of the electrical energy used at Shawinigan Falls is generated by direct-current generators directly connected to turbine water wheels located in two power houses built especially for this purpose, adjacent to the Shawinigan Water & Power Company's power house. The remaining portion of the energy is furnished from rotary converters which are supplied with alternating current from the Shawinigan Water & Power Company's circuits.

The Northern Aluminum Company's works includes, besides these two power houses, a rotary station, the necessary reduction plant for producing the metal from its oxide and a large wire mill in which aluminum electrical conductors are made.

General View of Northern Aluminum Company's Plant at Shawinigan Falls, Que.

The aluminum of commerce is produced by the electrolytic reduction of aluminum oxide (Al_2O_3), the process being that invented by the late Charles M. Hall, in which the aluminum oxide is dissolved in a fused bath consisting of a mixture of aluminum fluoride with the alkaline and alkaline earth fluorides. Mr. Hall was the first to discover that alumina is soluble in such fluoride baths and that the metal can be isolated therefrom by electrolysis, and this discovery is the basis of the aluminum industry as it exists to-day. The actual reduction is carried on in large rectangular iron pots having carbon linings, the bath with the dissolved alumina lying in a cavity in this carbon lining, which constitutes the cathode of the electrolytic cell. Suspended within the cavity is a large number of carbon electrodes carried by a suitable structure located above the pot. The use of a carbon lining in the pot is necessary because carbon is the only known material which will resist the attack of the fluoride bath. The carbon anodes serve the double purpose of leading the current into the bath and of chemically combining with the oxygen set free by the electrolysis, thus preventing the re-combination of the liberated oxygen with the aluminum formed. As each of these pots consumes only a few volts, the pots are connected in series with each other to form a circuit of sufficiently high voltage to permit the transmission of the power from the power houses to the pot circuits with reasonably low loss in transmission. In operation the bath is first fused by drawing arcs between the ends of the carbon electrodes and the carbon lining and introducing it gradually into these arcs. When a sufficient quantity of the bath has been fused, alumina is added and dissolves in the fused bath and the electrolysis begins. The process is carried on at a temperature of about 1,000 degrees C. and as aluminum melts at 656 degrees C. it is deposited upon the carbon bottom of the pot in molten form, and is periodically withdrawn from the pot by tapping, when a sufficient quantity of it has accumulated for that purpose. The oxygen liberated from combination with the aluminum is set free in contact with the carbon anodes and combines with them to form CO_2 and CO, in which forms the oxygen passes out of the bath. The carbon anodes are consumed by this chemical reaction and have to be renewed as fast as consumed. The aluminum, after being tapped from the pots, is poured into a mixing ladle where the metal from several pots is assembled and permitted to stand for some time to cause separation of entrained bath material and oxide. After this separation has occurred, the metal is skimmed and poured into ingot form ready for shipment.

The works of the Northern Aluminum Co., Limited, at Shawinigan Falls has always supplied nearly all of the aluminum used in Canada and a very large proportion of the metal which is exported from North America to Europe and other parts of the world. The production of aluminum conductors at Shawinigan Falls began in 1904, and nearly all of the important aluminum transmission lines in Canada have been made there.

In addition to this plant at Shawinigan Falls the Northern Aluminum Co., Ltd., has a fabricating plant located at Toronto. This fabricating plant contains a rolling mill for the production of aluminum sheet, a plant for the production of aluminum cooking utensils, and for the fabrication of other forms of stamped and spun goods, a casting plant for the manufacture of aluminum castings, and a job shop for the manufacture of aluminum tanks and

other aluminum products. One of the products which the Toronto works is well adapted to produce and which is of especial interest to the chemical industry, is the complete aluminum equipment necessary to the production of nitric acid by the various synthetic nitric acid processes which are in modern use. All of the metal used in this plant is supplied by the Shawinigan Falls works of the Northern Aluminum Co., Limited.

The Manufacture of Ferro-Silicon at Shawinigan

What is believed to be the record ferro alloys plant for speed in construction is that of the Canadian Ferro Alloys, Limited, located at Shawinigan Falls, P.Q., at the present time manufacturing 50 per cent ferro silicon.

On April 15th, 1918, two directors of a proposed company and an engineer, at the invitation of the Shawinigan Water & Power Co., arrived at Shawinigan Falls to look over conditions in general in regard to locating a ferro alloys plant. Up to this time there had been no direct work done by the interested people. While at Shawinigan Falls, all conditions were gone into and a proposed site looked over. On the 24th of April a representative of the power company and the directors of the proposed company and their engineer decided to go ahead; consequently on May 1st the engineer, a draftsman, labor foreman and electrician arrived at Shawinigan Falls.

Up to this time there had been practically nothing done and no material purchased, ground was broken three days later for the main building, which up to the time was not detailed. A small wooden shack was immediately erected for an office and drafting room, and details started. Sixty-seven working days from the first of May, the plant went into operation, and has been successfully operating since, turning a high grade of 50 per cent. ferro silicon.

To give some idea of the difficulty encountered: First, the entire staff were total strangers and were also handicapped in not being able to speak the prevailing language, which is French. In addition to this none of the material for building the plant could be purchased at Shawinigan Falls and had to be shipped in.

The tracing for the blue prints was made in the small office on the job, printed in a small print frame in the sun, and a small stream that ran across the property was dammed up and the blue prints were washed in the pool formed.

The building is of brick and steel construction throughout, consisting of a switch house, transformer room, furnace room, packing room, office, box factory, wash room and time office.

To get the plant in operation it was necessary to build two railroad sidings, one on the Canadian Pacific, to be used as a shipping track for the finished product, and one on the Canadian Northern, to be used as a receiving siding for raw material, the siding on the Canadian Northern is about 900 feet long, and consists of a grade track and unloading trestle, the unloading trestle being 45 feet high and 300 feet long.

The plant is ideally located, in that there is a difference of elevation between the two railroads of about 50 feet. The raw material is brought in on the upper level and is taken to the furnace room by gravity. The shipping track is below the level of the packing-room floor, and the finished product is also loaded by gravity.

The plant is laid out for six 5,000 kva. furnaces, one of which is in operation at this time.

The electrical equipment consists of 110,000-volt remote

General View Plant of Canadian Ferro-Alloys Co., Shawinigan Falls, Que.

control oil switch, with necessary controlling and protection devices. The transformers consist of 3 single-phase 1,500 kva., each connected in delta 66,000-volt primary 60-cycle. The electrode control is entirely automatic, using Thury regulators and winches manufactured by the Volta Manufacturing Company, at Welland, Ontario. The electrodes used are 16 in. by 16 in. square, three being used to each holder, making the electrode 16 in. by 48 in. These electrodes are manufactured by the Canadian Electrode Company at Shawinigan Falls. The furnace is of the standard type ferro silicon furnace.

The furnace is running on 90 per cent. power factor and about 88 per cent. load factor, and is believed to be the most successful 60-cycle alloy furnace in operation to-day.

Shawinigan Electro Metals Company and the Production of Magnesium

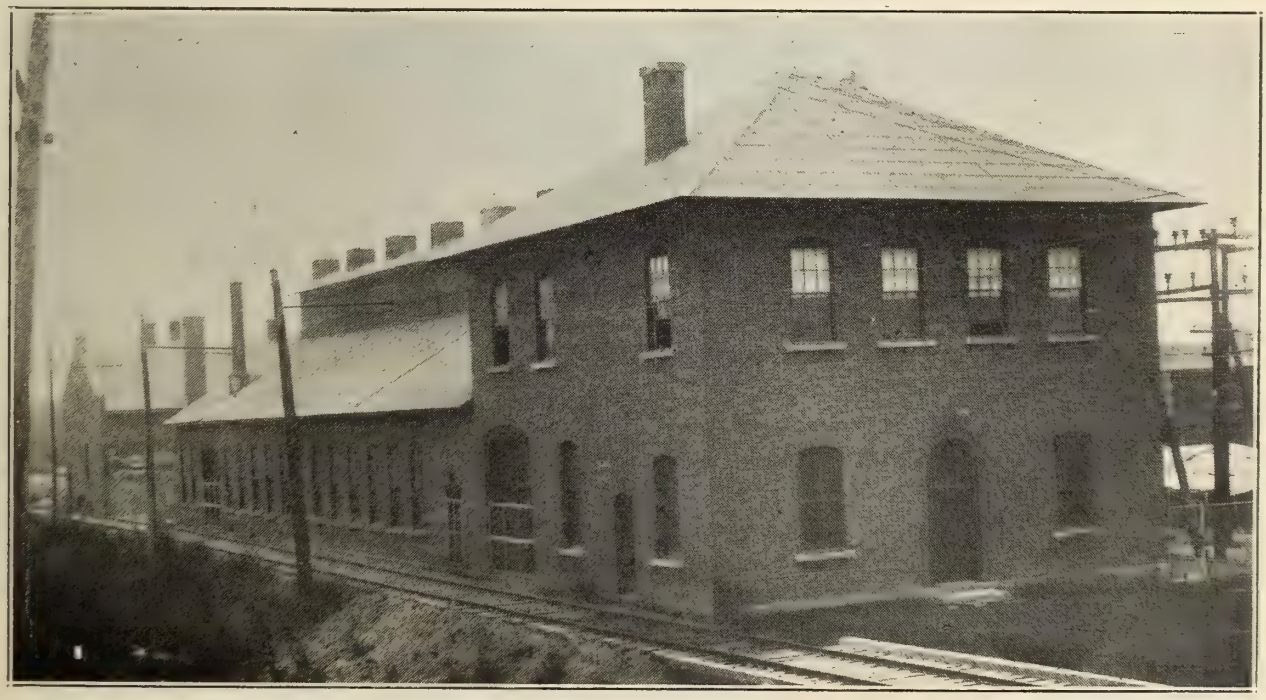
By P. H. FALTER*

The Shawinigan Electro Metals Company first engaged in the manufacture of magnesium to supply the war demands of the British, French and Italian Governments. Before the war there were no producers of the metal outside of Germany. The Shawinigan Company was very successful in developing practical processes of producing the metal and of turning it into the powdered form required for war purposes. The experience gained under stress of war necessity it proposes to develop into a permanent industry. The company has two great objects in view, for the attaining of which it has established two permanent lines of research in its laboratories at Shawinigan Falls. The first is to discover and apply improvements in processes of manufacture in order to produce the metal at the lowest possible cost. The second is a study of the methods of purifying, remelting, casting, rolling, drawing, extruding and otherwise working the metal and its alloys in order to extend their usefulness. Co-operation between the research laboratories and users of magnesium will be encouraged and welcomed. Uses of magnesium are only limited by the high cost of manufacture. The demand for this metal will increase very rapidly as its cost goes down. When it is considered that magnesium is one-third lighter than aluminum, and that many of its alloys are as strong as steel, and that they will not require the protection of paints to prevent oxidation, the number of uses to which they may be put is beyond the limit of the imagination. In the ever-increasing aircraft industry alone there is an insistent demand for light metals of great strength, which thus far has only been met by certain alloys of aluminum.

* GENERAL MANAGER SHAWINIGAN ELECTRO METALS CO.

Trade Commissioner Makes Report.

In the annual report of Mr. F. W. Field, Trade Commissioner for Great Britain at Toronto, many very interesting facts are given regarding the natural wealth of Ontario Province. So much is heard, and heard with good reason, about the wonderful resources of the newer provinces of Canada, that one is perhaps likely to overlook or forget Ontario. The need for the development of Canada's natural resources applies just as much to Ontario as the West or East, for much (a great deal more than is generally known) of Ontario's resources are yet undeveloped. For instance, of the 230 million acres of land in Ontario, Only 13½ million acres are under cultivation, and more than 20 million acres of the arable land are waiting for the first appearance of a plow. There are 4,300,000 horse-power in waterfalls still undeveloped in Ontario. For the past five years Ontario's mineral production averaged annually $46,000,000, of which $32,600,000 was metallic—chiefly silver, iron, nickel, gold and copper.



General View Plant of Shawinigan Electric Metals Co, Shawinigan Falls, Que.

BOOK REVIEWS

Chlorination of Water.

By *Joseph Race*, F.I.C., VIII+156 pages, 1918. John Wiley & Sons, Inc., New York. $1.50.

As Mr. Race very truly remarks in his preface: "No apology is necessary for the publication of a book on the chlorination of water. This method of treatment, practically unknown fifteen years ago, has advanced in popularity during the last decade in a most remarkable manner, and in 1918 over forty millions of people are being supplied with chlorinated water." When we examine the charts illustrating the elimination of the high typhoid fever death-rate in our large cities, and realize that this transformation has taken place within the last ten years, and that the chlorination of our water supply is by far the greatest factor in the eradication of this great plague, we no longer express surprise at the suddenness and the extent of its adoption.

Despite the almost universal use of chlorine by the large cities of the United States and Canada, England, conservative and somewhat skeptical, looked on doubtfully. The wonderful freedom from typhoid of our troops on the Western Front was, however, principally due to the chlorination of drinking water. This was one of the great contributions of the Western Hemisphere towards winning the war. England, largely as a result of the demonstration of the effectiveness of chlorination on the battlefield, has at last been converted.

The author's treatment and presentation of the subject is full and broad. His viewpoint is eminently sane and his perspective good. The book contains valuable information for a wide range of readers, from the medical officer of health of the great city to the member of the village council. In fact, every man in any degree responsible for supplying good water to a community, great or small, should possess a copy. The references to the literature are a valuable aid, and the author's plan of collecting these at the end of each chapter is much more convenient for the reader than massing them all at the end of the book, as is so frequently done. Mr. Race's book is not only wonderfully complete, but the text itself is remarkably free from the errata and typographical blunders that so frequently mar the first edition of many books.

Sufficient notice is scarcely given to the pioneer work done on chlorination in Canada. Experimental work was carried on at Toronto in 1909, and the city actually began chlorinating its water supply in March, 1910, a year earlier than Mr. Race indicates in his table on page 135. At this city to-day the water supply is both filtered and chlorinated, and doubtless the fact that Toronto has the lowest typhoid rate of any city in North America of over 100,000 population is principally attributable to these two complementary treatments.

Exception might also be taken to the explanation of the behavior of dilute solutions of bleaching powder given on page 18, the same being somewhat cumbersome, and, moreover, the chemistry itself is not unopen to criticism.

Mr. Race is very enthusiastic over the treatment of water with a combination of chlorine and ammonia. He maintains that in very dilute solution chloramine, NH_2Cl, is actually formed, and that this substance is as powerful a germicide as chlorine. Moreover, the "available chlorine" in the water decreases much more slowly than when chlorine is employed alone, hence the time during which the organism is exposed to the toxic agent is greatly lengthened. A two-fold advantage is claimed: First, lowered cost of treatment as a result of the smaller "dosage" necessary, and second, the absence of "aftergrowths." It is earnestly to be hoped that further investigation will confirm the author's contention. The recently published results of Dr. Frank E. Hale, Director of Laboratories of the Department of Water Supply, New York City (Engineering News-Record, March 20th, 1919), are, unfortunately, not encouraging. The chloramine treatment in the work referred to cost twice as much as bleach treatment, and, moreover, necessitated very strict laboratory control.

We hope that upon his return from active service Mr. Race will collect material for a second edition. This is highly desirable in view of the rapid changes taking place in this exceedingly active field; because, moreover, so great is the importance of water supply that all who are interested in it, professionally or otherwise, should have ready and speedy access to all particulars and improvements concerning the treatment of potable water by a method that is ever increasing in popularity.

E. G. R. ARDAGH.

Bacteriology and Mycology of Foods.

By *F. W. Tanner*. John Wiley & Sons, Inc. 592 pages, 89 cuts, 10 colored plates. Price, $6.00.

This is a very broad subject. Evidently the author has endeavored to show its relationships to other branches of what might be called the "Science of Health," and consequently has introduced a considerable amount of material not indicated by the title. It will be a surprise to many readers to find a chapter on the Bacterial Examination of Air, one on Water Hygiene (94 pages), and a final one of eleven pages on Epidemiology. Chapter I deals with the apparatus required for a bacteriological laboratory, special attention being given to the microscope and its manipulation. This contains twenty-nine illustrations, only two of which are of German apparatus. Several pages are quoted verbatim from the literature of The Spencer Lens Co., and of The Bausch & Lomb Optical Co. There are many surprising statements, evidently misprints. For instance, in describing slides, it states: "Different sizes are available, but those which are 2.5 x 7.7 mm. have widest use." There are many errors of another sort. In describing Lentz's method of making anaerobic cultures, the author says: "This requires a glass plate 125 mm. square and cellulose absorbent rings. Before using, the rings are soaked in pyrogallic acid and immediately before the culture is started in 1 per cent. potassium hydroxide." The punctuation is the author's.

Chapter II, dealing with media, is not free from inaccuracies. For example, on page 43 we read: "Bacteria require an alkaline or neutral medium." In the chemical formulae for the constituents of media, one does not expect to find such slips as the following: Sodium sulphate, $NaSo_4 1OH_2O$; ammonium lactate, $CH_3CHOHCONH_2$; potassium silicate, KSiO. There seems to be great difficulty in deciding upon names and formulae for the phosphates of potassium. On page 68, KH_2PO_4 is referred to as "bipotassium phosphate"; K_2HPO_4 is "dipotassium phosphate," and as "dibasic potassium phosphate." Chapters III and IV, dealing with Staining Technique, Classification and Description of Bacteria, are general in character and the treatment of the subject is not equal to that found in common texts on bacteriology. Repeated reference is made to "The Com-

mittee on the Chart for the Identification of Bacterial Species of the Society of American Bacteriologists." The methods given for the preparation of "Dakin-Carrel Solution" (this is used for the disinfection of wounds), without preliminary titration of the components, would certainly give haphazard results. It is not easy to see why the author should go out of his way to make this mistake, for it has no obvious bearing upon "The Bacteriology and Mycology of Foods." Chapter VI, on Proteins and Carbohydrates, contains a great many errors in chemical formulae and equations. The equation on page 189 is quite a curiosity: $2\,HI + Cl_3 = H_4O + I_2$. Others on pages 193 and 194 are of about the same quality. An attempt is made to give chemical methods for the analysis of fats—determination of the iodine number (Hanus), saponification number (Keottstorfer) and volatile fatty acids (Reichert-Meissl). Reference is made to the Official Methods of the A.O.A.C., 1912. Since these are entirely chemical and purely empirical, is it wise to try to condense them for a text book of this kind? Incidentally, it might be noted that there is a later edition of the methods referred to, published in the Journal of Official Agricultural Chemists, 1916. The chapters on water and milk are characterized by liberal quotations from the Standard Methods of the American Public Health Association. A considerable portion of this is chemical and is better dealt with by some of the books already on the market.

By a curious mistake in paging, part of Chapter X is printed twice. Apparently a sheet on Dissolved Oxygen has slipped in with those dealing with Chlorination (330-331); it is printed again on page 345. Chapter XII (28 pages, with 8 colored plates), which deals with eggs, is by far the best chapter in the book. In this, the bulk of the material and the plates are from the work of Benjamin (New York Agric. Exp. Sta. Bull. 353). In fact, the chief value of the book lies in the direct and fairly well chosen quotations from the published researches of various recognized authorities and from the Official Methods of Committees. These would no doubt be appreciated by those who have not access to the originals. The bibliographies appended to each chapter certainly impress the reader with the necessity of having a working reference library. The Appendix might be shortened by omitting the Alcohol Table on page 561-2. It is quite useless because no temperatures are specified. Why not use the table of the Bureau of Standards? Apparently Dr. Tanner was rather uncertain of his product, for in the Preface we read: "The author will appreciate helpful suggestions and criticisms from those who use this book. Only by the help of them may the errors and crudities in the first edition of any book be corrected for later editions." The criticisms noted above are offered in response to this invitation.

H. M. LANCASTER.

CHEMICAL ANALYSIS DEMANDED AT ARGENTINA.

Preserved food products for importation into Argentina are now, by a recent decree, subject to chemical analysis.

Under this decree the Customs Houses are to take samples from every one thousand kilograms of preserved food products of the same shipment or consignment. Those samples are then to be sent to the National Chemical Office for analysis, where one of the samples is to be thoroughly analysed in order to ascertain whether the goods from which it was taken are fit to be allowed into the market. The remaining samples of the shipment are to be submitted to analysis for purposes of proof and control.

Chemical Society News

MEETING OF MARITIME CHEMISTS

The Maritime Chemists' Association met in Sydney, N.S., on July 15th and 16th. Mr. A. F. Blake, chief chemist of the Atlantic Sugar Refineries, Limited, St. John, read a paper on "The Evolution of Coal," in which he developed an equation based on the analysis of the coal to determine the value as a fuel. He also showed a nomographic chart enabling the solution of the equation to be carried out with a minimum of effort.

Mr. I. C. Mackie, chief chemist of the Dominion Iron & Steel Co., Sydney, read a paper on "The Use of Benzol as Motor Fuel," which appears in this issue.

Dr. H. Jermaine Creighton, of Swathmore, Pa., read a paper describing the Landreth direct oxidation process for the electro-purification of sewage and showed lantern slides of the plant, and gave analytical and bacteriological data showing the efficiency of this method. He also gave cost data for an installation.

A paper by Dr. A. McGill, of the Trade and Commerce Department, on "The Chemist's War," was read by title.

Committees were appointed to deal with the question of the formation of a section of the Society of Chemical Industry and to approach the Government relative to the representation of the Maritime Provinces and its industries at the forthcoming Exposition at Chicago.

The members were afforded an opportunity to visit the coke oven and rolling mill plants of the Dominion Iron & Steel Company.

PERSONALS

Mr. J. R. Donald, of the J. T. Donald & Sons, chemical engineers, Montreal, has been appointed chief chemist for the Matthews-Blackwell Co., Toronto, packers.

Mr. E. V. Pannell, Canadian manager for the British Aluminum Company, Ltd., 265 Adelaide Street West, Toronto, has returned to the home office of the company in England and his duties here have been assumed by Mr. E. E. Driver, of England.

Mr. J. A. Dawson, M.A., B.Sc., chemist in charge of the Food and Drug Laboratory, Department of Trade and Commerce, Vancouver, B.C., has returned to Vancouver after an extended trip through the East, which included his attendance at the Montreal conventions of chemists in May.

Dr. F. N. G. Starr, of Toronto, has had bestowed upon him the decoration of Commander of the Order of the British Empire for the distinguished surgical services he rendered in France as medical officer with the Canadians.

Dr. R. F. Ruttan, head of the Chemical Department of McGill University, Montreal, was in England during July, where he attended the International Convention of Chemical Societies at London, July 15th, as representative of the Canadian Society of Chemical Industry. On July 18th he attended the International Convention of Research Councils at Brussels, Belgium, as representative of the Canadian Honorary Advisory Council.

Captain Joseph Race, F.I.C., late secretary of the Ottawa Branch of the Society of Chemical Industry, has returned from Siberia with a detachment of the Siberian Expeditionary Force. He passed through Toronto, Kingston, and Montreal on his way to England, making visits with

friends. In England he attended the annual general meeting of the society, July 15th.

Colonel W. R. Lang, who has relinquished his duties in Military District No. 2, to resume his chair as head of the Department of Chemistry, University of Toronto, is renewing acquaintances in England prior to the university opening this autumn. Col. Lang was the first chairman of the Society of Chemical Industry of Canada.

Dr. Ellis I. Fulmer, recently of the Faculty of Arts, Department of Chemistry, University of Toronto, has accepted a position as assistant professor of chemistry at Iowa State University, Ames, Iowa.

Mr. Harold S. Davis, formerly lecturer on chemistry in the University of Manitoba, and since then head of the research department of the H. Koppers Company, of Pittsburgh, Pa., has resigned to accept a fellowship donated by the Texas Gulf Sulphur Company in the Mellon Institute, Pittsburgh. Mrs. Davis, who has also been in the research department of the Koppers Company for the last six months, will assist her husband in his work in this new field.

Mr. K. L. Dawson, B.Sc., chemical engineer and assistant superintendent of the gas department, Halifax Electric Tramway Co., Halifax, N.S., has become a member of the Canadian Gas Association.

Major J. E. McCorkill, formerly with the Toronto branch of the National Drug and Chemical Co., has received the D.S.O. He was in command of No. 2 Company, 2nd Battalion, C.M.G.C. He is now at his home in Belleville, Ont., on leave.

Mr. Herbert J. Brennen, B.Sc., is now with the R. W. Hunt & Co., Montreal.

Mr. James H. Brennen, B.Sc., is employed as chemist with the St. Lawrence Sugar Refineries, Ltd., Montreal.

Dr. E. E. Braithwaite, M.A., Ph.D., has resigned from the presidency of Western University, London, Ont.

Dr. Amyot, formerly of the Medical Faculty, University of Toronto, has been appointed Deputy Minister of the newly formed Federal Department of Health, Ottawa.

Mr. Harry S. Mork has resigned as vice-president of Arthur D. Little, Inc., of Cambridge, Mass., and has been elected to the vice-presidency of the Lustron Company of Boston, manufacturers of artificial silk by a process developed in the Little establishment. He will also act as consultant to the Industrial Company of Boston.

Dr. Arthur C. Neish, who for the past twenty years has been on the staff of the Department of Chemistry, Columbia University, New York City, has accepted the Chair of Chemistry at Queen's University, Kingston, Ont., and will undertake his new duties with the opening of the University in October Dr. Neish is a Canadian and a product of Queen's.

On July 1st Major Clarence J. West, recently in charge of the editorial department, Research Division, Chemical Warfare Service, assumed his duties as director of the information department of Arthur D. Little, Inc. While with the Chemical Warfare Service he prepared about fifty monographs on different phases of chemical warfare, dealing particularly with war gases, smokes, incendiaries, absorbents, etc. In his new position Major West will extend the library facilities of the organization and develop a special information service on technical and scientific subjects for the benefit of the clients and staff of Arthur D. Little, Inc.

INDUSTRIAL ALCOHOL IN ENGLAND.

A large quantity of industrial alcohol is needed by the dyestuff and fine chemical industry and for other technical purposes in England. The annual report of the Customs and Excise for the year ending March 31st, 1918, shows that 6,951,396 proof gallons of industrial methylated spirit and 1,244,470 proof gallons of mineralized methylated spirit were produced during the year. In the same period 4,283,974 bulk gallons of industrial and 778,586 bulk gallons of mineralized spirit were sent into consumption by the makers. About 30,000,000 proof gallons of pure spirit were used in connection with arts and manufactures. These figures disclose the fallacy of the argument, states The Dyer, of London, Eng., that the galling control of industrial alcohol is a small matter, too trivial to have much effect on the prosperity of our industries. As a matter of fact, but for these irritating restrictions and regulations, much more alcohol would be put to advantageous use in the technical arts. And it might be added that but for other restrictions of the Canadian Government, industrial alcohol in Canada would have a much better chance.

DISTRIBUTION OF GERMAN POTASH.

The Distribution Office for the Potash Industry has regulated the sales of potash during 1919 as follows:—

	Home sale. Double cwt. pure potash (K_2O)	Sale abroad
Carnallite, containing not less than 9% and not more than 12% K_2O	39,000	.....
Crude salts with 12—15% K_2O ...	3,700,000	421,000
Fertilizer salts—		
20—22% K_2O	1,216,000	680,000
30—32% K_2O	49,000	6,600
40—42% K_2O (including fertilizer salt of 38% K_2O)	946,000	266,000
Chloride of potassium	3,015,000	56,500
Sulphate of potash—over 42% K_2O	72,200	230
Sulphate of potassium and magnesium	20,600	46,500
Totals	9,057,800	1,476,830
Grand Total	10,534,630	

SHORTAGE OF CHEMICAL FERTILIZERS.

There was a scarcity of chemical fertilizers in Mexico this summer for the sugar and tobacco crops.

Before the war the great bulk of these chemical fertilizers were imported direct from Germany, and they amounted at the port of Vera Cruz to something over 2,000 tons per annum.

From several years of past experience, with the help of the German governmental authorities (who sent their analytical chemists to study the composition of the soil and the requirements necessary for the obtaining of the best results from these fertilizers), it was found that the three component parts that were considered most suitable were sulphate of ammonia, superphosphate, and potash. This year many British and American fertilizer firms sent large consignments to Mexico, following the announcement of a shortage.

INDUSTRIAL SECTION

Construction, Manufacturing and Market News

[This department is reserved for news items of interest to the chemical and metallurgical industries and to those doing business with companies using chemical products. Literature from firms and announcements will receive attention. A monthly review of market conditions and Canadian prices is given. You are invited to report news items at any time, and confer with us regarding the activities of the Canadian chemical and allied industries.]

P. F. McCleary, Manager of Industrial Department.

British Columbia.

Kamloops.—The possibility of establishing a woollen industry here from wool produced in British Columbia is engaging the attention of the Kamloops Board of Trade.

Queensborough.—"Industrial Progress" reports that the British Columbia Manufacturing Company has secured a permit to build a new export plant here, on what was formerly the provincial jail farm.

New Westminster.—The Canadian Western Cordage Company, composed of returned soldiers, will erect a $250,000 plant here to make rope and twine.

Sidney.—An addition to the plant of the Sidney Rubber Roofing Company is planned to cost $125,000.

Vancouver.—The Canada Carbide Company are contemplating the establishment of a plant here.

The Electric Manufacturing Company will erect a new factory on Industrial Island for the manufacture of heavy type slate-back switches and new type of externally operated switches.

The Mainland Engineering Company will erect a new plant on Coal Harbor.

"Industrial Progress" reports that the Rothert Process Steel Company, of Seattle, has applied to the B. C. Government to guarantee bonds, amounting to $300,000, on condition that the company shall use the money to move to Vancouver or vicinity. The company makes tool-steel from the titaniferous magnetites of Texada Island.

A. E. Solloway is erecting a manufacturing plant on Richards Street.

An experimental plant for the treatment of complex ores will be completed within the next few months. The Government has voted $100,000 for this purpose, and the plant will give a mill test of complex ores. The alkaline process for the separation of ores, now under investigation in the United States, will likely be established here. Zinc and lead have been separated by this method.

Manitoba.

St. Boniface.—Tenders for a flour mill, to cost $375,000, will shortly be asked for by the Clare Milling Company.

New Brunswick.

Milltown.—The water power at Salmon Falls has been purchased by the St. Croix Cotton Company, who will build a power plant at Calais, to operate their plant by electricity. An addition to the factory is said to be in line.

Moncton.—A. Humphrey & Son will erect a new factory, to cost $35,000.

Reports have been received of a rich strike of oil at Sydney Creek, near Moncton, N.B., at a depth of about 2,600 feet. Further reports are awaited before judgment is passed on the value of the well.

St. John.—The Nashwak Pulp & Paper Company is installing a chemical laboratory at their plant. Mr. House is the chief chemist in charge.

Nova Scotia.

Bear River.—Clarke Bros., Limited, are entering the sulphate pulp business, erecting a plant of 10,000 tons annual capacity. A. G. McIntyre is the new president of the company.

Halifax.—The Imperial Oil Company is doubling the present capacity of their refinery here. Ocean-going vessels can dock at the company's wharfs and take on a cargo of oil.

Ontario.

Brantford.—The Electric Tin Products Company will establish its plant here, seven of the ten directors being Brantford men. Property near the Verity Plow Works has been secured, and an electric smelting system will be installed, current being supplied from Hydro-Electric power. The tin ore will be obtained from South America.

Bancroft.—A plant to cost $500,000 is under consideration by the Canada Marble Company.

Brockville.—Twenty-four acres have been purchased by the Board of Trade, which will be disposed of as factory sites to United States manufacturers.

Bridgeburg.—The Canadian Niagara Bridge Company has secured an option on land near here, for the widening of the approaches to the proposed new bridge over the Niagara River.

Chatham.—A delegation from the Chatham Waterworks Commission recently inspected the new, rapid, sand wate-filtration plant at Amherstburg, Ont., changes in the Chatham system being contemplated. The Amherstburg plant was constructed by Brunner Mond Co., and was put in operation in March of this year.

Cobalt.—It is announced here that the Cassel Cyanide Company of Scotland, the largest cyanide firm in the world, will locate a subsidiary company in Canada. This is good news to the mines of North Ontario, as cyanide is used extensively in gold mining. The present supply comes from the United States, and is of low grade.

Elmira.—A factory addition and warehouse will be built to the Great West Felt Company's plant.

Gravenhurst.—In the case of Keith vs. Gravenhurst Crushed Granite Company, before Mr. Justice Sutherland at Osgoode Hall, Toronto, the plaintiff has obtained an injunction restraining the company from leasing its plant or assets to the National Potash Corporation or taking any steps involving the plaintiff with the potash corporation.

Hamilton.—The Industrial Varnish Company will erect a plant here at a cost of $100,000.

A branch factory will be erected here by the Quaker City Chemical Company of Philadelphia.

Poirits & Spencer, of Bury, England, felt manufacturers, will erect a $600,000 plant here for making felt for paper-making machines, also woollen blankets.

Haileybury.—The United Iron & Machinery Company

will shortly call for tenders for the erection of foundry and machine shops; estimated cost, $100,000.

Kitchener.—Five acres have been purchased on King Street West for the erection of a plant for the manufacture of rubber goods. Mr. C. Reider, president of Ames-Holden-McCready Company, made the announcement.

Consulting Engineer Hodgins, of Syracuse, N.Y., investigated Kitchener's water shortage, and recommended extension to the Grand River as the only hope of a future adequate supply.

Listowel.—The erection of a flax mill here is planned by the Canadian Flax Mills, Toronto.

London.—Work is commencing upon the new additions to the Holeproof Hosiery Company, Bathurst and Clarence Streets. H. P. Elliott is engineer in charge of erection, and associated with him are Messrs. Lockwood, Green & Company, of Chicago, experts on equipment for textile mills.

Leamington.—The Imperial Tobacco Company will erect a plant and power house at a cost of $125,000.

Marmora.—James Best reports the discovery of a large vein of feldspar rock, containing a high percentage of potash, at Bird's Creek, near Marmora. Mr. Best states that a Philadelphia company will work the property.

Peterboro'.—The local Board of Health has recommended that a filtration plant be added to the city's water service. Property has already been secured on which to erect the plant.

Port Colborne.—A cork manufacturing plant, to employ about one thousand men, is expected to locate here. The name of the concern has not been made public as yet.

Preston.—The Preston Arena Company, Limited, plan to build an artificial ice plant here, at a cost of $30,000, with opening day on October 15th next. The plant will be for skating rink hockey purposes.

St. Catharines.—The Imperial Oil Company will build a $20,000 supply plant here.

Sault Ste. Marie.—An extension to the Algoma Steel Corporation's mill is being made.

St. Thomas.—Fire occurred at the St. Thomas Packing Company's plant, July 9, but was controlled to a damage loss of about $300.

Thorold.—After a strike lasting over four weeks, the employees of the Beaver Board Company returned to work on July 21. The working hours have been divided into three shifts of eight hours each.

Fire broke out in the basement of the Ontario Paper Company's plant here, the largest paper mill in Canada, on July 21st. Damage to building, $4,000; to machinery, $8,000; all covered by insurance.

General View of Canadian Aloxite Plant, Shawinigan Falls, Que.

Mount Forest.—A $10,000 addition will be made to the foundry of Ernest Bros.

Niagara Falls, Ont.—Stuart Bros., of Niagara Falls, Ont., manufacturers of essential oils for the confectionery, bakery and grocery trades, are removing their works to Montreal.

The Dominion Chain Company have instituted a system of profit-sharing among their employees, also a plan providing for insurance of employees, sick and funeral benefits, and annual vacations with pay.

Oak Ridges.—The Gendron Manufacturing Company will erect a factory here.

Oshawa.—The Ontario Steel Products Company, of Gananoque, Ont., have been granted a fixed assessment of $20,000 for ten years on the factory buildings they propose to erect here.

Ottawa.—The Beach Company, Spencer Street, will build a new $75,000 factory.

Owen Sound.—The Dominion Oil Company will establish a plant here.

Tillsonburg.—The Canadian Cereals Flour Mills, Limited, have been working on twenty-four-hours' schedule on export orders.

Toronto.—The Canadian Ice Machine Company, 82 Chestnut Street, have let contracts for a $40,000 plant.

The Wm. Neilson Company, confectioners, will build an addition to their factory on Gladstone Avenue.

An addition will be made to the factory of the Goodyear Tire & Rubber Company at New Toronto.

Gelber Bros., woollen manufacturers, will erect a $65,000 factory building, Richmond Street West.

W. J. Keen, 259 Spadina Avenue, is calling for tenders for the erection of a factory.

The Holden-Morgan Munition plant, Coxwell Avenue, has been sold to the John Wood Manufacturing Company, of Conshohocken, Pa., which will employ 300 men in the manufacture of range boilers.

Additions are being made to the plants of the Blatchford Calf Meal Company and of the Brunswick-Balke-Collender Company of Canada.

The Northern Aluminum Company will erect a ten-storey addition of reinforced concrete to their factory on Sterling Road.

Mr. Allan O. Thorne, import and export broker, has taken over the business formerly known as McKee & Thorne, and will extend the present business into all lines of chemicals, dealing especially in magnesium sulphate, caustic potash and vegetable oils.

Vankleek Hill.—An extension to the plant of the Perfection Manufacturing Company is under consideration.

Walkerville.—The first textile industry in the border cities district will be located at Walkerville. The Peabody Manufacturing Company will erect a $500,000 plant here for making textiles.

The Acme Roofing Company will erect a new factory.

Work is progressing on the plant of the General Motors Corporation.

Windsor.—The new sewage system for Ford, Walkerville and Windsor, designed to prevent the dumping of raw sewage into the Detroit River above the waterworks intakes of Windsor and Walkerville, is completed at a cost of $120,500.

The Champion Spark Plug Company of Canada will erect a one-storey factory.

Hiram Walker & Sons are constructing a one-storey addition to their power building on Devonshire Road at a cost of $18,000.

Quebec.

Chicoutimi.—Additions are contemplated to the Chicoutimi Pulp Mills, which, if carried out, will bring the annual capacity up to 140,000 tons.

Granby.—The Miner Rubber Company will erect a $35,000 factory.

Laval.—Fire recently destroyed the metal stamping works of the Laval Industrial Co.; loss, $18,000.

Montreal.—A plant in Montreal East has been secured by the Gates, Refractories, Limited, and the erection of kilns and installation of equipment is in progress. Refractory bricks for furnaces will be made. This concern was formerly the John W. Gates, Limited, but has been reorganized with capital stock of $25,000.

A plant will be erected in the east end by the Mount Royal Rubber Company.

The American Druggists' Syndicate, 24 Craig Street West, will erect a factory.

The Montreal Board of Harbor Commissioners will erect a $1,000,000 cold storage plant, work on which is expected to commence in the near future. The plant will be located inside Victoria Pier, and the aim is to save some of the produce that arrives in precarious condition from the West.

Messrs. Hugh Russell & Sons, Limited, who have been engaged in the steel and iron business since 1868, have recently added a department of heavy chemicals, and have opened offices in the Royal Insurance Building, Montreal, having arranged to take the Canadian representation of one of the largest chemical firms in England.

Quebec.—The Marceau Oilcloth Company will erect a factory.

An addition is being erected to the plant of Lachance and Tanguay.

Shawinigan Falls.—A factory will be erected by Joseph Boisvert.

Sherbrooke.—A new factory for the Kayser Glove Company will be erected on Frontenac Street.

Three Rivers.—The Page Wire Fence Company will erect a $150,000 plant.

Saskatchewan.

Regina.—A new office and warehouse building is being erected by the Ontario Wind Engine & Pump Company.

General View of Plant of Belgo Pulp & Paper Co., Shawinigan Falls, Que.

NEW YORK LETTER

Special Correspondence to the Canadian Chemical Journal by F. M. Turner, Jr.

New York, August 1st, 1919.

Hearings with regard to the licensing system for the protection of the American dyestuff industry and also the American potash industry, are in progress before the Ways and Means Committee at Washington.

The plant of the Union Dye and Chemical Company at Kingsport, Tenn., has shut down pending adjustment of certain contracts with the government. This is the plant formerly owned by the Federal Dyestuff and Chemical Company, which failed a few years ago. The Union concern have been operating the plant since about a year ago. Mr. A. A. Matheson, formerly with E. I. duPont de Nemours & Co., being in charge.

The Chemical Foundation, Inc., organized to take possession of enemy patents on dyestuffs, pharmaceuticals, etc., and to issue non-exclusive licenses to American firms, has brought suit against the Anglo-French Drug Company to compel them to cease the importation of organic arsenical commodities, patents on which are owned by the Foundation.

Hon. Mr. Bacharach, of New Jersey, is introducing a bill shutting out free entry of scientific instruments, laboratory apparatus, chemical glassware, chemical porcelainware, optical glass, etc., to the United States. Once there was a good reason for this provision, as American scientific institutions had to procure such supplies from Europe. There is no need for importing such material to-day. Enterprising American firms have undertaken the manufacture of all of the above and American chemical glassware and chemical porcelain are even superior to the imported product. It is expected that in future a duty of from 45 to 60 per cent. will be charged.

Large Export Company Suggested.

The Chemical Alliance, Inc., through its foreign trade committee, has suggested the organization of a $15,000,000 chemical corporation formed in accordance with the Webb law. The stock is to be subscribed by chemical manufacturers participating in the plan and the profits will be distributed as dividends. It is pointed out that the formation of such an export company would provide a natural outlet for surplus production, would take care of transportation problems, would be able to combat unfair foreign competition, would facilitate financing large export business, and would eliminate undesirable brokers and other middlemen. On the committee are such important members of the chemical industry as Dr. William H. Nichols, of the General Chemical Co.; Mr. Henry Howard, of the Merrimac Chemical Co.; Mr. H. G. Clopper, of the New Jersey Zinc Co.; Dr. Bernhard C. Hesse, of the General Chemical Co.; Mr. S. B. Leary, of the American Agricultural Chemical Co., etc.

The Potash Situation.

Considerable interest has been taken in the hearings before the Ways and Means Committee at Washington relative to the potash question. Dr. George Otis Smith, of the U.S. Geological Survey, testified that no import duty would be sufficient to protect the industry, but advocated a licensing system by which farmers would be allowed to purchase foreign potash after they had purchased a stipulated quantity of domestic potash. According to Dr. Smith, under existing conditions, domestic potash can only supply about half of the domestic needs. It was contended by Mr. M. Parker, of Washington, attorney for the U.S. Potash Producers' Association, that protection for a few years would enable the American industry to develop to a point where it could take care of all domestic requirements in competition with foreign production, and might even compete for export business. In connection with this discussion all of the various industries using potash are to be given hearings, including the manufacturers of dyestuffs and chemical glassware.

News and Personal Items.

Mr. Henry W. Wigglesworth has returned from Europe, where he was sent by the United States Government to make an official inspection of the chemical and dyestuff plants in the portion of Germany occupied by the Allies.

A fire at the Edgewater, N.J., plant of the Corn Products Refining Co. recently caused a loss of about $100,000.

A fire at the Brooklyn plant of the National Aniline and Chemical Co. (formerly the Beckers plant), completely destroyed one of the forty units of the plant.

A sulphuric acid and fertilizer plant, costing $750,000, is being built at Tulsa, Okla.

A meeting of the newly organized Dye Section of the American Chemical Society will be held at Philadelphia, September 2nd to 6th. It is expected that this meeting will be the largest assemblage of technical and business men interested in the dyestuff industry ever gathered together in America.

Mr. N. J. Lane, chemist in the laboratory of the U.S. Appraiser's Office, and a well-known member of the Chemists' Club, New York, is slowly recovering from an attack of apoplexy.

Mr. L. Hoshour, formerly with Eimer & Amend, is now with the New York branch of the Denver Fire Clay Company.

Dr. Wallace Cohoe, of New York, formerly a resident of Toronto, is writing a book on chemical specifications, to be published in the near future.

Dr. Ellis I. Fulmer, a recent recipient of the degree of Ph.D., from the University of Toronto, has been spending a few weeks in New York City and vicinity, prior to going to Iowa University, where he has been appointed an assistant professor of chemistry.

Dr. John E. Teeple, of New York, has left on a business trip to the Pacific Coast, where he is expected to remain some weeks.

Mr. A. E. Marshall, works manager of the Davison Chemical Company, Curtis Bay, Baltimore, Md., has returned from a trip to England.

Major Charles V. Bacon has resumed his consulting chemical work in New York City after an absence from civilian life occasioned by his acting as chief of the Engineering and Standardization Branch of the General Staff of the U.S. Army.

Mr. Herman Coors, of the Herold China and Pottery Co., Golden, Colo., is spending the summer at Siasconsett, Mass.

Canadian Government Publications

By S. J. Cook, B.A., A.I.C., Public Analyst, Department of Trade and Commerce, Ottawa

(NOTICE: Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

ADVISORY RESEARCH COUNCIL.

Nicotine and Tobacco Waste—Report No. 4, 40 pp. By A. D. Hone, M.A.

The high price of nicotine sulphate led the Advisory Council to investigate the possibilities of extracting the nicotine from the quantities of waste tobacco in the form of dust and stems, and Mr. Hone was commissioned to do the work, and this report contains his findings. The bulletin deals with the use of nicotine as an insecticide in a general way, the growing of tobacco for its nicotine content, and the quantity of nicotine obtainable from the various parts of the plant. Analyses are given and four methods of extraction with the results found from each are described, steam extraction being said to be the most efficient. The value of tobacco waste as fertilizer and as a source of potash is further mentioned and their possibilities commented upon. This is the first work on this subject that has been done in Canada and the Advisory Council are to be congratulated upon the general merit of the report.

An Investigation into the Question of Early Putrefaction of Eviscerated Fish in Which the Gills Have Been Left—Report No. 6. 4 pp. By Louis Gross, M.D.

From this report it seems advisable to remove the gills from the fish in order to prevent to some extent early putrefaction.

COMMISSION OF CONSERVATION.

Forests of British Columbia.—By H. N. Whitford and R. D. Craig. 409 pp., 28 plates, 21 maps.

The publications of the Commission of Conservation are among the leaders of Government publications in point of style and general make-up, and the present is one of the best. The reason for the work reported in this publication is probably to be found on the first page where, in an excerpt from an address by Sir Clifford Sifton, these words occur: "It has been found by hard experience that national safety demands that nations should not only possess resources but understand them and be able to utilize them economically. . . The lack of developed capacity to utilize every possible resource may in certain emergencies mean disaster." The primary object of the investigation now reported was to secure an estimate of the available supply of timber in the province, but in the securing of these data, other information was gathered and its incorporation has served to amplify the report in a way that is desirable. After the Introduction, there are three main divisions, of which the second is the one dealing with the forest resources of the province. This comprises 84 pages. The first section deals with the geographical, physiographic, climatic and soil relations to the main subject, together with chapters on forest administration of Dominion and Provincial lands, general forest policies, the forest trees of British Columbia and insect injuries to forests in that province. The third section consists of three appendices, giving timber sale contract, volume tables, and the British Columbia log scale.

Three years were spent by the compilers of this report, much of the time being spent in the Pacific Province in order that first-hand information might be obtained, and the report now reviewed will undoubtedly prove a valuable contribution to the literature on the subject of our forest resources.

DEPARTMENT OF THE INTERIOR.

Forestry Branch.—Bulletin 66. Utilization of Waste Sulphite Liquor. 195 pp. By Dr. Bjarne Johnsen and R. W. Hovey, B.Sc., of the Division of Pulp and Paper, Forest Products Laboratories of Canada.

Almost without parallel in the history of Government publications this excellently compiled review of the literature on the subject of waste sulphite liquors is issued from a Government branch to be a boon to every chemist who has any interest in this subject. It is of unquestioned value as there can be no move towards the elimination of the waste as it exists to-day without reference to the literature, much of which is only available in the larger libraries and some of which is not available at all in this country. So it is that chemists will receive this publication with pleasure because it is a contribution of the sort that ought to be made from Government Laboratories but which, unfortunately, they are almost never allowed to prepare and less often to publish.

The references are given in chapters according to the nature of the recovered products and a short discussion has been added in the form of an introduction to each of the more important chapters. The titles of these chapters are: Composition; Effluents; Binding Material; Gums, Adhesives and Sizing Materials; Tanning Materials; Alcohol; Fuel; Fodder; Fertilizer; Dye; Sulphur; Evaporation; Miscellaneous; General. These are followed by an Index of Authors which discloses the fact that 350 names of those who have reported officially on the subject of waste sulphite liquors are given. This serves the dual purpose of showing how extensive the study of the subject has been and also how thoroughly the literature has been reviewed for material for this volume. To the chemist, it is the most satisfactory publication the Government has contributed to the scientific world in a long time.

DEPARTMENT OF TRADE AND COMMERCE.

Commercial Intelligence Branch.—Weekly Bulletins 799-803.

The first of these has a good account of Canada's exhibit at the Lyons Fair, where 55 Canadian firms were represented. Twenty pages of description of this world's market place during its activities are used to record Canada's share.

Food and Drug Laboratories.—Bulletin No. 425. Mineral Waters. 32 pages.

One hundred and thirty-eight samples of mineral water, representing 62 brands, were analyzed in the course of work of which this is a report. Sixty-four Canadian waters of 33 different brands were found in the collection. This is the first collection of mineral waters that has been made by the Food and Drug Laboratory, and the work on Canadian mineral waters is the first that has been done on the subject; foreign waters have been investigated and the results of analyses published before. The bulletin gives the analyses of all the samples examined in full, so it constitutes a reference of permanent value to future investigators as well as to the public and the trade who are in-

terested at the moment. It is recommended that mineral water should be defined in Canada and that when medicinal claims are made for any of these waters, the receptacle in which it is sold should bear a copy of an analysis of the contents, and that fortified or artificial waters should be so labelled.

Final Report of the Fuel Controller, March, 1919. 107 pp., 3 charts, 1 map. This report is divided into two parts. The first deals with the fuel situation in Canada during the war; the second attempts to forecast fuel conditions of the future, with particular reference to means of promoting the conservation of coal. This division is based on the theory that the lessons of the past, as shown in historical review, must be learned by those who would lay plans for the future economy of our fuel resources such that the greatest good may be had by the greatest number of the people in whose interests this work has been carried on. The first section deals with the policy followed, the sources of supply available, distribution, consumption, and a summary of the results achieved. The same headings are used in the next part, but the subject-matter refers to the fuel problems as they may be met in Canada, and Canadian resources as yet undeveloped are considered. Two appendices consist of articles specially written for the Fuel Controller, one by Warren Blauvelt, of Detroit, on "The Economic Utilization of Fuels," and the other by F. E. Lucas, of the Dominion Steel Corporation, Sydney, C.B., on "The Coal Resources of Canada, Their Relation to the Industrial Development of the Country."

The bulletin is well printed and contains a great deal of information which may well be read with interest by the man on the street.

Monthly Bulletin of Agricultural Statistics, May, 1919. 23 pp.

Crops, crop reports, the weather, news of the Institute of Agriculture, and crop reports from other countries, including the area sown to cereals in the Northern Hemisphere, and grain prices.

Weekly Bulletins, Nos. 804-807. The first of these numbers contains a complete list of British import restrictions, including (1) an alphabetical list of goods which may be imported from foreign countries without license; (2) list of goods which may not be imported without license; (3) prohibitive imports. No. 805 gives a list of chemical and metallurgical products which may now be exported from Japan without license. In 806 a new British gas-steam engine is described briefly, and in 807 the possibilities of Latin America are set forth compellingly by the editor of the New York Commercial. In all these, Canadian grain statistics and trade inquiries are a regular feature.

Report on the Coal Trade of Canada for the Year Enging March, 1918. 60 pp. The report deals briefly with the production and importations of coal, but is, for the most part, devoted to the distribution and consumption of coal within the several provinces. A review of the leading incidents in the trade during the year is included in the introduction. The whole is supplementary to the report of the Fuel Controller, in which the statement of the administrative work is given.

Report on the Grain Trade of Canada for the Crop Year Ending August, 1918. 69 pp. This report is issued by the Internal Trade Division of the Dominion Bureau of Statistics in collaboration with the Board of Grain Commissioners. The object of the report is to show the movement of grain in Canada from the producer to the final markets. It represents a considerable enlargement on previous statistics and is the first attempt to deal with the report showing graphically the streams of grain as they flow across the continent and out to the sea on their way to the foreign markets.

Directory of Chemical Industries in Canada. 60 pp.—Mention only of this publication is made here as it will be reviewed at length in the next issue It gives a list of the names, addresses and products of five hundred Canadian firms engaged in the manufacture of chemicals or other products made through the agency of chemical change. There has already been a very large demand for copies of this publication and it seems likely that it will go to a second edition.

Dominion Bureau of Statistics.—Monthly Bulletin of Agricultural Statistics, April. Stocks on hand, stocks of grain, distribution and exportable surplus of grain and crop reports from the provinces.

Monthly Report of the Trade of Canada, March. 365 pp. Imports for consumption and exports of Canadian and foreign produce as compiled from the reports of the Department of Customs. This is the book the prospective promoter of new enterprises in Canada should read.

Annual Report of the Trade of Canada for the Year Ending March, 1918. 1,052 pp., 50 pages of historical matter relative to Canadian trade, including a number of analyses of current trends in trade, are followed by detailed tables showing: Imports for consumption and exports by articles during the year 1918; imports for consumption by articles and countries for the years 1914-1918; imports under the British Preferential Tariff, the French Treaty Tariff, for the year 1918; exports of Canadian produce by articles and countries for the years 1914-1918 and exports of foreign produce for the same period. This volume constitutes the sum of the knowledge in Canada regarding imports and exports for the period it covers, and is therefore one of the most valuable of the compilations made by the Dominion Bureau of Statistics. There is no filler in the way of long discussions; the reader must form his own conclusions from the tables given.

The Canada Year Book, 1918.—686 pp., 1 map, 2 plates. Cloth bound, English and French editions.

The "Jubilee" edition of the Year Book, probably the best-known of Government publications, has just been published. A number of changes have been made in its composition this year, mostly in the way of dropping from the present record statistics which have become historical. This has resulted in the elimination of 35 pages of printed matter, but the essential and desirable features of the Year Book, as it is so well known, remain. Added to it is "The Story of Confederation," by Sir Joseph Pope, Under Secretary of State for External Affairs, who has done nobly by the important subject entrusted to his able charge. A frontispiece, "The Fathers of Confederation," illustrates the story and at the same time serves to bring before the eyes of the younger folk in Canada those faces which are now a memory to but a few; the faces of the men "in whose hearts and minds the Dominion of Canada was born." Mr. Ernest H. Godfrey, F.S.S., editor of the Year Book, provides a statistical article, entitled "Fifty Years of Canadian Progress, 1867-1917," in which the growth and development of the country is described and given permanent record. The tables of the Year Book are too well known to need further comment here. The volume is obtainable from the Bureau of Statistics, or the Distribution Office at Ottawa.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

Considerable activity as compared with June marked the chemical trade in Canada during the month of July. In no one particular chemical, however, was the buying more noticeable than in another, with the possible exception of magnesium sulphate, for which there were some good calls. The general condition of the market is at present decidedly better that it has been for some time past, and it is not overstating the truth to say that the chemical trade in Canada is now on a better basis, with more actual sales, than in pre-war days. Naturally one must discount this statement to some extent when it is remembered that the years 1913-1914 were none too good in any business.

Magnesium Sulphate—The market in Epsom salts was over-sold in Toronto during the last week of July. Some dealers were several cars behind in their orders. Despite this fact the price remained stationary, with .04 cents per lb. as a maximum price.

Tartaric Acid—Tartaric acid crystals are running from 95 cents to $1.05 per lb., an advance of five cents during the month. The beverage industries are calling heavily on tartaric, due to scarcity of citric.

Sulphuric Acid—The price of sulphuric has not moved a fraction of a cent for the past twenty days. The market in sulphuric acid is still firm and holding to a level that seems to show no tendency to wabble either up or down.

METALS.

Iron and Steel—The market in iron and steel in the United States looks better than it has for some time. Buying has lately been more than 60 per cent. of the productive capacity of the works, and this output must be for permanent or construction work as normally more than 50 per cent. of the steel passes into permanent use. This fact disproves the view that the buying for permanent use has been abnormally small, and that the majority of the sales were for current use or every-day consumption. The truth is, there has been undoubtedly at least a moderate amount of buying for permanent work, and it is this fact which causes the steel trade to occupy a favorable place among those who have money to invest. Steel is really cheap to-day, compared with other articles, as it leaves the mills, because finished steel products are now about 80 per cent. above their ten-year pre-war average, whereas commodities in general stand at double their averages for the ten years prior to the war. This is an added reason why steel is a good investment to-day. Investors are likely to urge construction work to begin immediately as construction costs are probably as low as they are likely to be for several years to come.

Copper—On August 15th copper metal was quoted in New York at 23½ cents per pound for spot delivery during August and September. Among the New York tradesmen in copper the view is that the price will advance even more, some suggesting 26 cents per pound as a possible maximum that may be reached. The market in copper has shown increased strength all through the past month of July. It is predicted that there will be a scarcity of copper shortly because of the fact that the mines are working on curtailed time and that much of the copper now being sold is coming from the surplus stocks which, as the demand for copper increases, will decrease, and even after the mining companies finally resume full operations it will require a period of from four to five months to replenish the stocks.

Spelter and Lead—Spelter has advanced a half-cent per lb. and lead one cent during the past month, and trading in these metals has been more active than for some time.

Molybdenite—The price of molybdenite has dropped to below a dollar per lb. since the Armistice was signed. All the mines working on this metal in Ontario have closed down.

OILS.

Turpentine—The highest price in turpentine since the Civil War has been reached when the market closed at Savannah, at $1.77 per gallon on August 4th. By the time to buy turpentine could have it from $2.75 to $3.00 per gallon from the jobbers. The price dropped to $1.50, due to the belief that the United States Government was going to bring the price down, but rose again to $1.52½. The two largest producers in the South, each employing over 5,000 hands, on July 31, notified their agencies, including Toronto and Montreal men, that their output for the season had been sold, and that no more orders would be handled this season. The cause for this situation, in brief, is, that the present supply of turpentine stocks is about 50 per cent. of what it was in pre-war days, and the demand is getting increasingly greater, not only for export to Europe, but locally as well. The cause of the shortage in stocks in the South is due to the fact that negroes who formerly worked for $10 to $12 per week have been, during the U. S. war marine activities, working on government boats at good wages, and refuse to return to their former toil at the old wage schedule. Then, again, when the war first started, and Germany, the largest European importer of turpentine, was cut off from the trade, many of the smaller dealers in the South were forced out of business, so that what with labor harder to secure, and less dealers getting out the product, turpentine stocks are lowered tremendously. And, then, as said before, the demand has, since Germany was allowed to re-enter the market after the war, greatly increased. Great Britain and the Allied nations are also ordering very heavily, hence the present top-notch price.

Linseed—With flax seed at over six dollars per bushel in Winnipeg, one need not be over-surprised at the price of linseed oil from the jobbing trade in Toronto and Montreal, namely, $3.25 per Imperial gallon. It is interesting to note that five years ago flax seed was sold at Winnipeg at $1.65 per bushel. What is the wherefore? The United States have bought heavily of Canada's seed crop, and in addition the U.S. cannot get shipments of Argentina seed due to difficulties in shipping, chiefly the dock strikes at Argentina ports. On a large liner from Siberia bringing home Canadian troops there was a cargo of ten thousand tons of flax seed straw bales consigned to a New York firm. This shows the difficulty houses are experiencing in getting the seed when a New York company will order the seed from Siberia and have it threshed in New York. In comparing linseed oil with turpentine the latter is in reality not so high in price, when it is considered that turpentine is a distilled product, secured from trees which when once destroyed in producing the oil, cannot be replaced inside of a few years; whereas, linseed oil is obtained from an annual crop. Perhaps it is a truth that turpentine has in former years been too cheap, and many dealers and chemists will bear us out in this belief. In neither turpentine or linseed is there any prospect of a decrease in price.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	.90
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.04½—.05½
Acetic acid, refined	Lb.	.20½—.21½
Acetone	Lb.	.18½—.23½
Aspirin, in 100-lb. lots	Lb.	1.20—1.35
Alcohol, pure, bbl., 65% O.P.	Gal.	8.25
Alcohol, methylated, bbl.	Gal.	2.00
Alcohol, wood, 95%, refined, bbl.	Gal.	2.00—2.20
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.10—.12
Ammonium Carbonate	Lb.	.30
Ammonium Chloride	Lb.	.15—.20
Benzoic Acid	Lb.	1.30
Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused	per Ton	$25—$30
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	.04¾—.05¼
Chloroform	Lb.	.40—.58
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.20—1.30
Cobalt Oxide, black	Lb.	1.65—1.90
Copper Sulphate (Blue Vitriol)	Lb.	.09½—.10
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.24½
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesite, calcined	per Ton	—25.00
Magnesite, clinkered	per Ton	—35.00
Magnesite, raw	per Ton	—10.00
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¼—.04
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Oleic Acid	Lb.	—.23
Potassium Bi-Carbonate	Lb.	—.41
Potassium Bromide	Lb.	—.72
Potassium Hydroxide (Caustic Potash), 100 to 500 Lb. lots		—.40
Potassium Hydroxide (Caustic Potash), 25 to 100 Lb. lots		—.42
Potassium Hydroxide (Caustic Potash)	in sticks	—1.50
Potassium Nitrate, kegs	Lb.	.22—.24
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.10—3.25
Salicylic Acid	Lb.	.45—.60
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.14—.16
Sodium Cyanide, bulk, 98-99% in cases	Lb.	.34—.35
Sodium Nitrate, refined	100 Lbs.	6.75—7.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.00—5.50
Sodium Benzoate	Lb.	1.10—1.20
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bichromate, bbls.	Lb.	.18—.19
Sodium Nitrite	Lb.	.15—.16
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	2.50—2.75
Sulphur, roll	100 Lbs.	4.00—4.25
Sulphuric Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphite, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.95—1.05
Tin Chloride, crystals	Lb.	—.60
Zinc Sulphate, com.	Lb.	—.06
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	.10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.21
Cobalt, metal	Lb.	—2.50
Cobalt Oxide, grey	Lb.	—1.75
Copper, casting	Lb.	—.25
Copper, electrolytic	Lb.	—.26
Copper, electrolytic, in car lots	Lb.	.25
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.07½
Lead, in car lots	Lb.	.06
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.12
Spelter	Lb.	.10
Spelter, in car lots	Lb.	.08
Steel, mild	100 Lbs.	—5 00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	—.65
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.32
Motor Gasline (service stations)	Gal.	—.35
Lighting Gasoline	Gal.	—.37
Naphtha	Gal.	—.31
Coal Oil	Gal.	—.20½
Fuel Oil	Gal.	—7.00
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	24 to 28c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 30c	per gallon
Dip Oil, 20 per cent.	38 to 46c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Flake	.08½ to .09½c	per pound
Naphthalin Balls	10½ to 11½c	per pound
Alpha-Naphthylamin	45 to 50c	per pound

Flotation Oils and Naval Stores

Spirits of Turpentine, in bbl. lots (Imperial), gal.	2.05—2.10
Rosin, Grade G, in 280 bbl. lots	28.0
Rosin, Grade W.W., in 280 bbl lots	33.00

Vegetable Oils

Castor Oil, (Medicinal), in bbl. lots	.35 lb.
Castor Oil, (Commercial), in bbl. lots	.30—.32 lb.
Cocoanut Oil, (Refined)	.26 lb.
Linseed Oil, raw, in bbl. lots, (Imperial), gal.	3.25
Linseed Oil, boiled, in bbl. lots (Imperial), gal.	3.28

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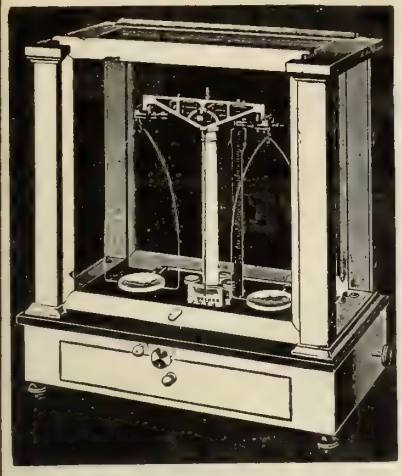

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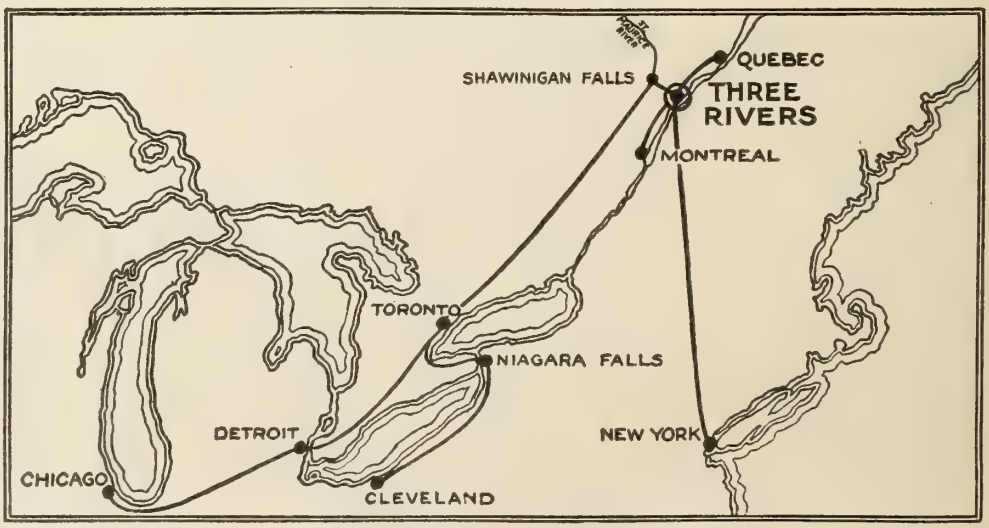

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MINING OPPORTUNITIES IN NORTHERN MANITOBA

Mineral Areas

Approximately three-fifths of the total area of Manitoba is Pre-Cambrian, and all but a small part lies in Northern Manitoba. In the Pre-Cambrian in Ontario, the well-known camps of Sudbury, Cobalt and Porcupine have been developed. In Northern Manitoba there was practically no prospecting until the Hudson Bay Railway gave access to the mineral districts. There are three fields in particular to which attention is now directed—The Pas Mineral Belt, the Cross and Pipestone Lakes area, and the Oxford Lake, Knee Lake, God's Lake and Island Lake area.

Development

Since 1915, development has been rapid in The Pas Mineral Belt. Twenty million tons of low-grade copper ore have been explored by diamond drilling at Flin-Flon Lake. High-grade copper is exported from Schist Lake to the smelter at Trail, B.C.; three and three-quarter million pounds of copper have already been realized. Copper prospects are under development on Athapapuskow Lake, Copper Lake and Brunne Lake. The building of a smelter will give impetus to the development of a large copper industry. Gold is now produced at Wekusko Lake, and important discoveries have been made on Copper Lake, and on Knee Lake on the Hayes River route.

Transportation

Transportation is available by the Hudson Bay Railway, by the Ross Navigation Co. Steamboats on the Saskatchewan River, and by wagon roads built into the producing areas by the Manitoba Government. Wekusko Lake may be reached in less than one day from The Pas. The Hudson Bay Railway gives easy access to several promising districts where little prospecting has yet been done.

Mining Regulations

The mineral resources are under Federal control, and the Dominion Mining Laws apply to Northern Manitoba. No mining license is required. Work to the value of $100 per year must be performed for a period of five years on claims filed under the quartz mining regulations. The office of the Mining Recorder for Northern Manitoba is at The Pas.

Opportunities for Capital

The district is comparatively new, and there are several very promising properties which may be acquired at reasonable prices. Financial and mining companies would be well advised to have their engineers inspect these properties at an early date.

For maps, reports and general information, apply to

The Commissioner of Northern Manitoba,

The Pas, Manitoba

ONTARIO'S RESOURCES

PROVINCE OF ONTARIO
DEPARTMENT OF LANDS FORESTS & MINES
BUREAU OF MINES

G. H. FERGUSON, Minister

Apart from the products of the farm, those of the forest and of the mine are of special interest to the chemical and metallurgical industry of America. Ontario's forest and mineral wealth is receiving wide attention and offers great opportunities for the investment of capital.

Forests: Pulpwoods in abundance afford the raw products for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically every mineral, with the exception of coal and tin, is found in the premier mineral province of Canada. Complete figures of output as compiled by the Ontario Bureau of Mines show a valuation of $80,308,972. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:—

Silver	$185,027,590	Nickel	$138,010,542
Pig Iron	78,925,917	Gold	50,864,863
Copper	49,947,080	Cobalt	5,918,899

MINERAL STATISTICS OF ONTARIO FOR 1918.

METALLIC.

Product.	Quantity.	Value.
Gold ..... ounces	411,878	$ 8,502,480
Silver ..... "	17,738,153	17,415,882
Copper ..... lbs.	1,211,922	270,430
Copper in matte (a) ..... tons	22,951	8,262,360
Nickel in matte (a) ..... "	44,297	26,578,200
Iron ore, exported (b) .... "	107,273	624,364
Iron, pig (c) ..... "	50,072	1,364,736
Cobalt, metallic ..... lbs.	404,348	887,960
Cobalt oxide ..... "	477,583	727,170
Nickel oxide ..... "	406	106
Nickel, metallic ..... "	3,450,550	1,262,116
Other nickel and cobalt compounds ..... "	453,515	73,347
Lead, pig ..... "	1,670,251	149,841
Molybdenite, concentrates "	47,614	59,067
Total metallic		$66,178,059

NON-METALLIC.

Product.	Quantity.	Value.
Actinolite ..... tons	228	$ 2,508
Arsenic, crude and white.. lbs.	5,090,818	566,332
Barite ..... tons	60	900
Brick, fancy and pressed. M.	25,377	396,698
Brick, common ..... "	49,498	665,454
Brick, sand-lime ..... "	7,941	91,508
Cement, Portland ..... bbl.	1,226,244	$1,910,839
Corundum ..... tons	137	26,120
Feldspar ..... "	19,784	111,173
Fluorspar ..... "	7,286	153,190
Graphite, crude and refined "	2,934	208,848
Gypsum, crushed, ground and calcined ..... "	38,214	151,564
Iron pyrites ..... "	270,966	1,144,737
Lime ..... bush.	2,650,285	872,177
Mica ..... tons	275	49,575
Mineral water ..... Imp. gals.	298,498	133,808
Natural gas ..... M. cu. ft.	13,075,742	2,498,769
Petroleum, crude .... Imp. gals.	10,106,615	781,097
Pottery	.....	88,275
Quartz ..... tons	213,420	452,711
Salt ..... "	131,726	1,287,039
Sand and gravel ..... cu. yds.	1,023,497	553,638
Sewer pipe	.....	362,536
Stone, b'ld'g, trap, granite, etc.	.....	869,239
Talc, crude and ground ... tons	17,465	246,691
Tile, drain ..... "	13,087	309,899
Tile, hollow building ..... "	.....	195,588
Total non-metallic		$14,130,913
Add metallic		66,178,059
Grand total		$80,308,972

(a) Copper and nickel in the matte valued at 18 and 30 cents per pound respectively.
(b) Total shipments of iron ore, 198,882 tons.
(c) Production from Ontario ore only.

Industrial Opportunities: Midway between West and East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities, both by rail and water, are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Hydro-electric power, both potential and developed, is available. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula.

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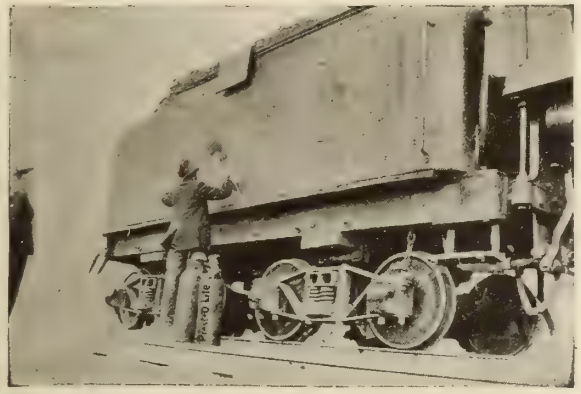

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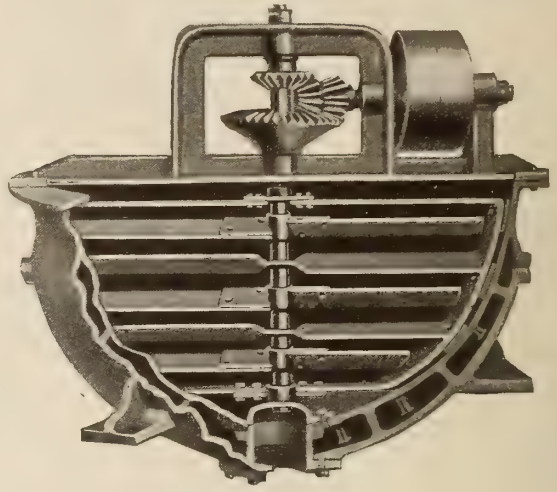

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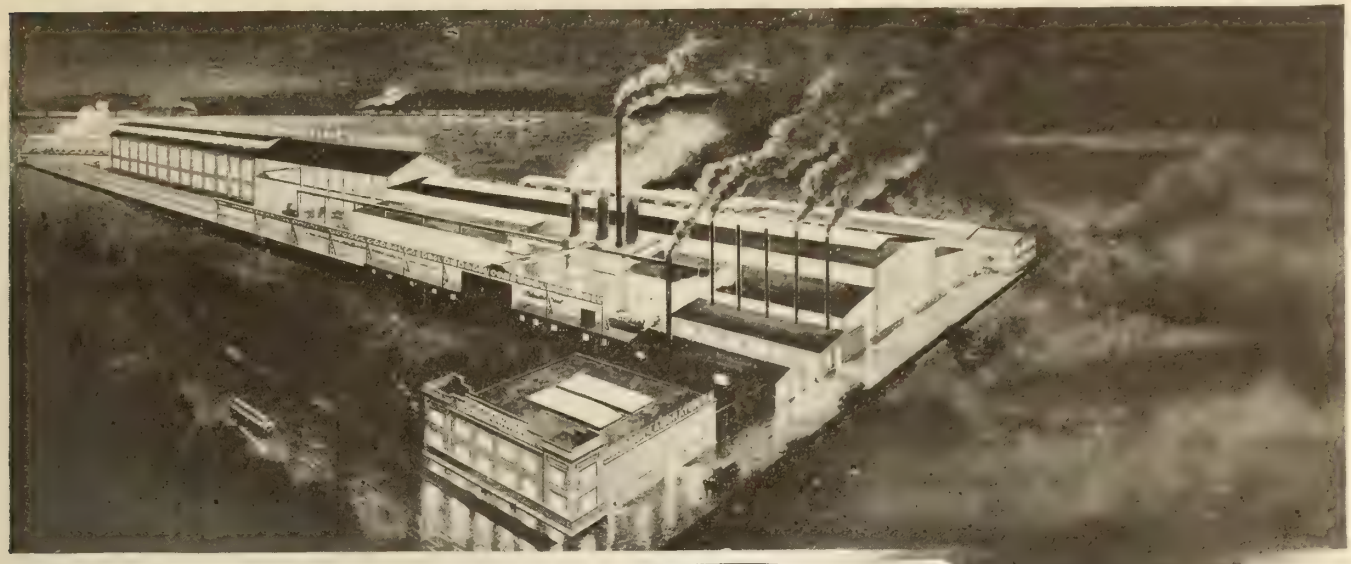

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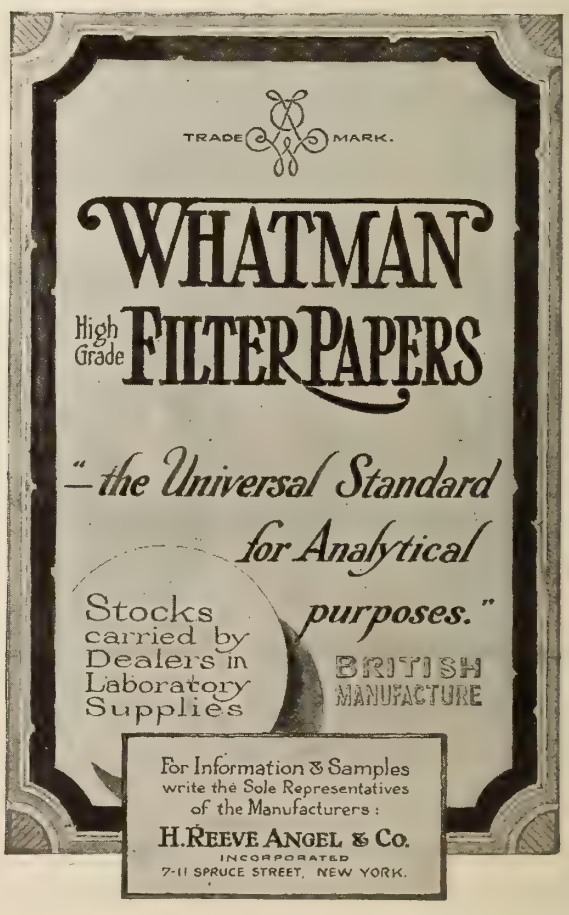
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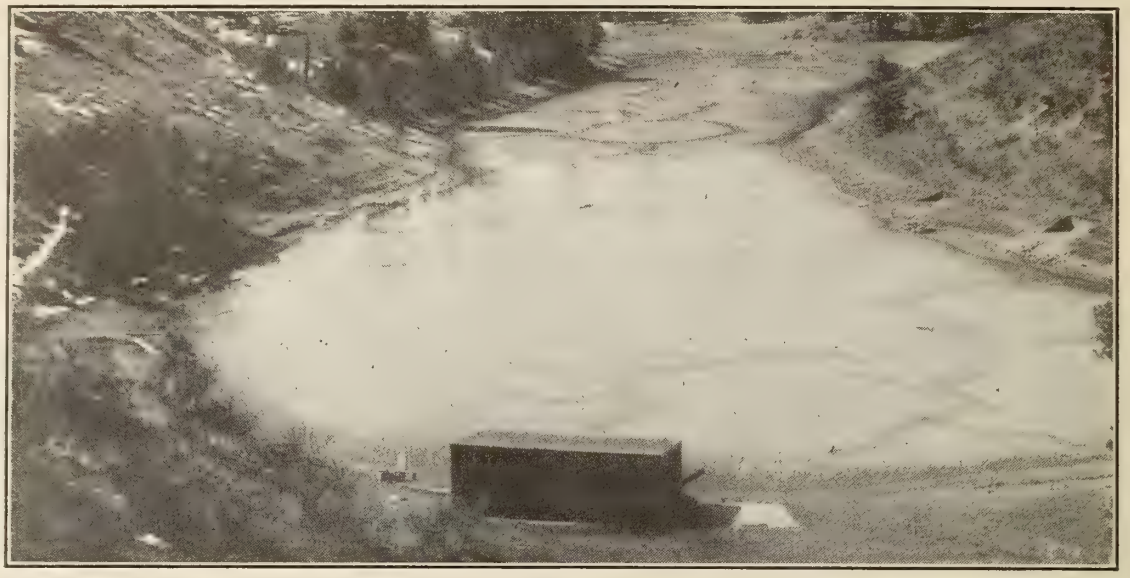

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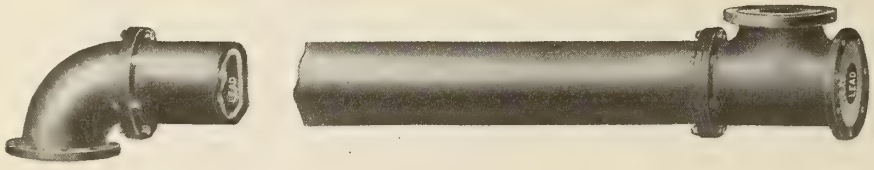

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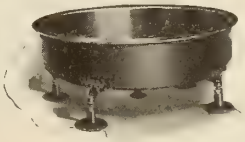

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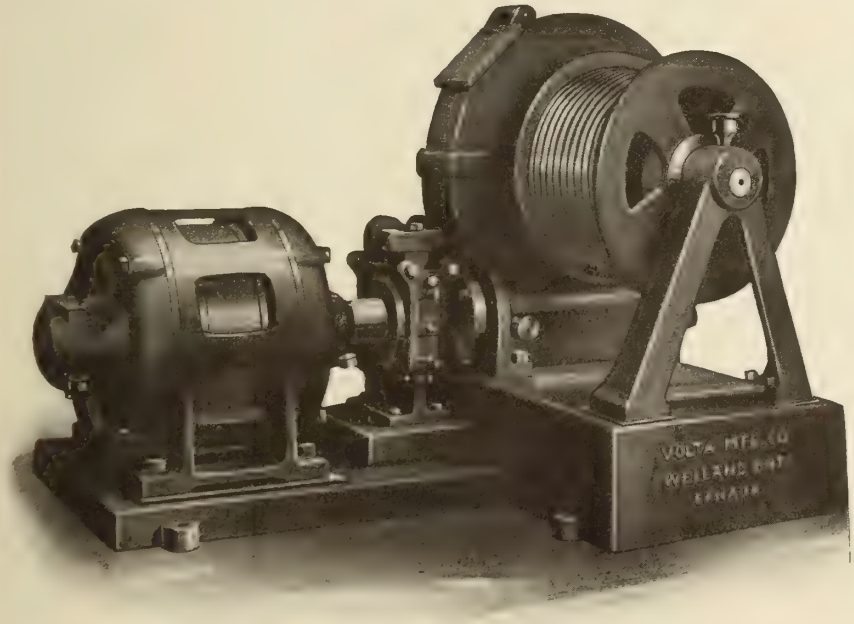

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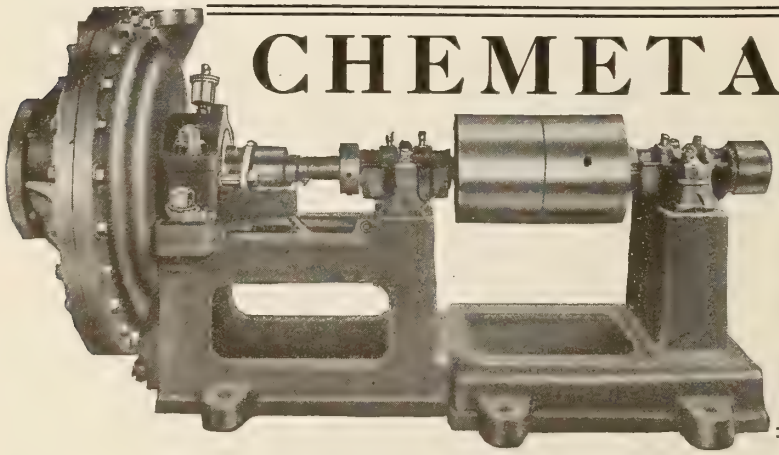

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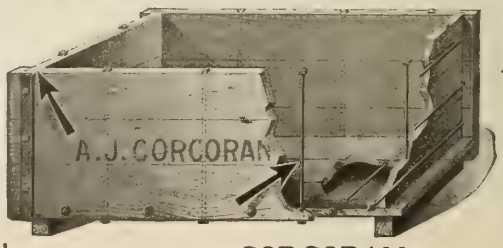

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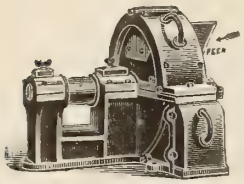

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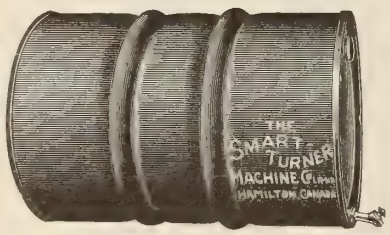

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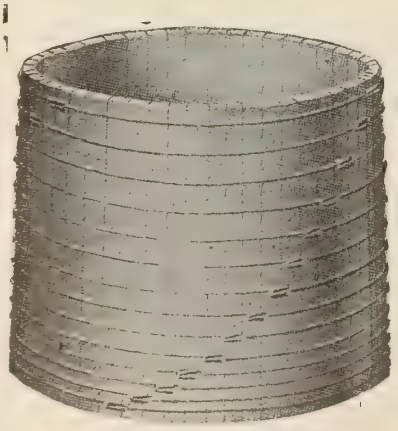

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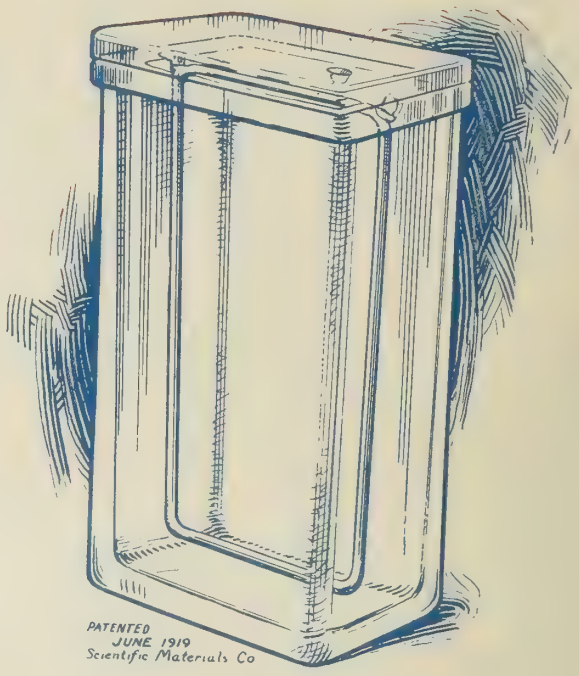

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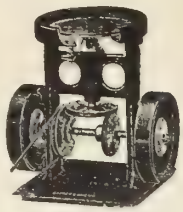

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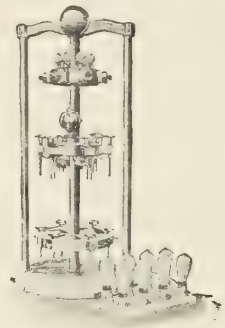

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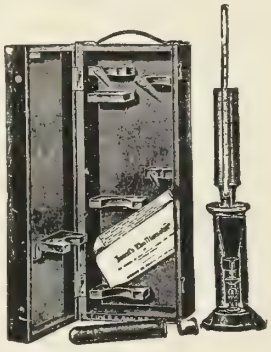

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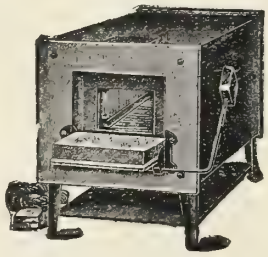

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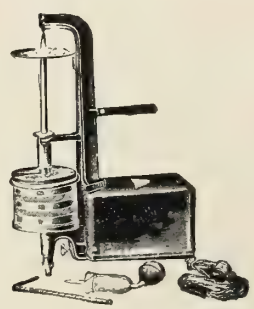
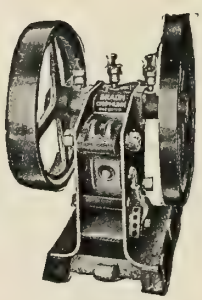
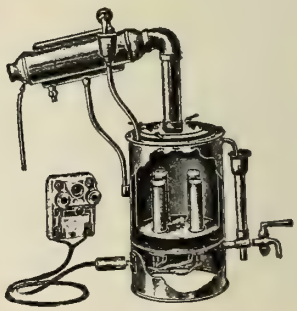


Mac Michael Viscosimeter



Braun Grinder



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In the bulletins mentioned, we explain their construction and tell what they will do. If you are on our mailing list, you have received copies of these publications. If not, you will receive them at once upon request.

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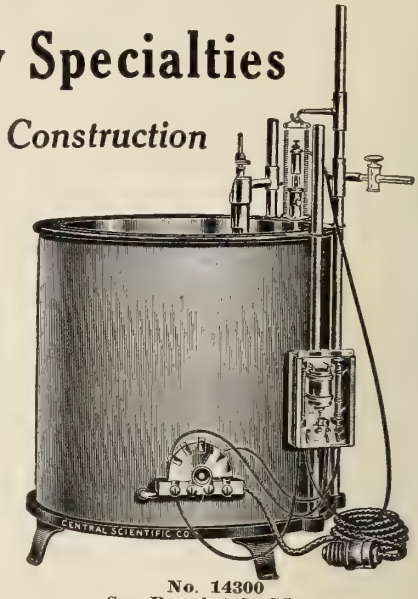
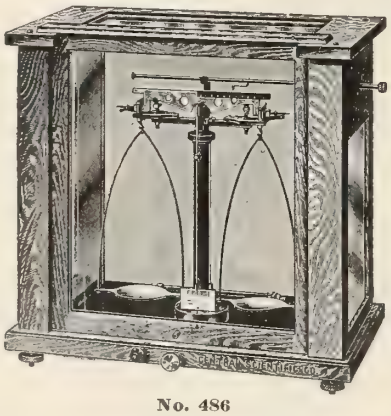


No. 14300

See Reprint 3, CJ



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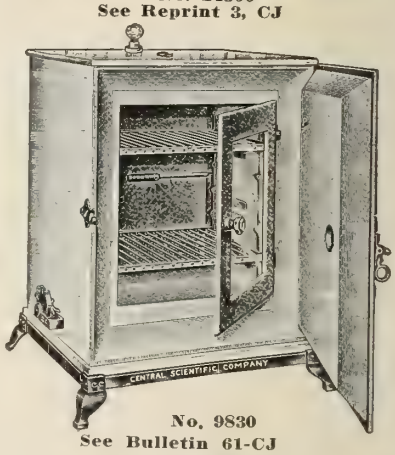
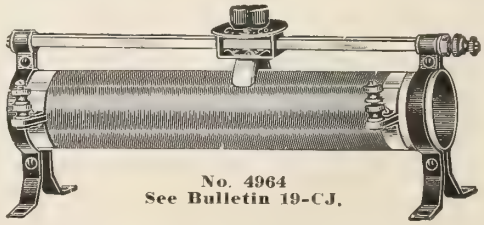


No. 9830

See Bulletin 61-CJ

No. 11000

See Bulletin 45-CJ.



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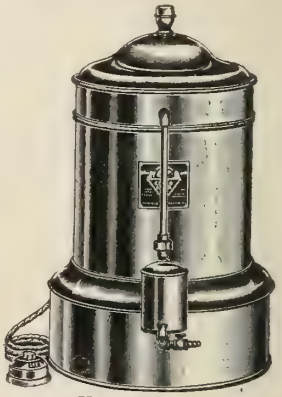

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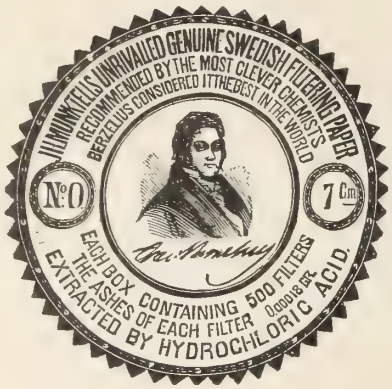
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EXTRACTED BY HYDROCHLORIC ACID.

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As sole American Agents for this world-famous brand of Filter Paper, we wish to notify the trade that, on account of the removal of shipping restrictions by the United States War Trade Board, which reduces the trouble and expense of obtaining Import Licenses, the reduction of war insurance rates and the greater availability of shipping space as well as a general reduction of war-time expenses, we are glad to quote a reduction from recent prices on this much-desired commodity.

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Present prices for this Filter Paper follow:

1808. **No. OO. FOR SPECIAL SCIENTIFIC WORK**—Washed with hydrofluoric and hydrochloric acids. Cut in round filters, 100 filters in a package, five packages in a box of birch bark.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$1.50**	**1.65**	**2.40**	**3.00**	**3.30**	**3.75**	**6.30**

1810. **No. O. WASHED FILTERS**—Washed with hydrochloric acid, removing traces of iron, alumina, lime, etc. The ash is reduced to a minimum, and a high standard of purity is secured. A uniform and quick filter, retaining fine precipitates; adapted to the most precise requirements of analytical work.

In square sheets, 48 x 48 ctm. per quire **7.50**
Cut in round filters, 100 filters in a package, five packages in a box of birch bark.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.60**	**0.81**	**1.26**	**1.65**	**1.89**	**2.55**	**3.75**

1812. **No. OB. WASHED FILTERS**—Washed in hydrochloric acid, same quality as No. O; however, somewhat heavier; filtering more rapidly and retaining the finest precipitates. This is a new paper and will be found satisfactory for the most precise analytical work.

Cut in round filters, 100 filters in a package, five packages in a box of birch bark.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.69**	**0.90**	**1.44**	**1.89**	**2.10**	**2.85**	**4.20**

1814. **No. 1F. The Original Swedish Paper**—Of best linen material, most perfect filtering paper made; leaves one-third less ash than formerly the smallest amount of any unwashed paper. Very strong, adapted to the highest class of chemical work. The finest precipitates are retained.

Per ream of 480 sheets; size, 48 x 48 ctm. **60.00**
Per quire **3.60**

Cut in round filters, 100 filters in a package, five packages in a box of birch bark.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.33**	**0.48**	**0.75**	**0.90**	**1.20**	**1.50**	**2.25**

1816. **No. 2. A Pure White Linen Paper of Medium Thickness,** not as closely made, therefore more rapid in filtration. A superior paper for all laboratory work.

Per ream of 480 sheets; size, 48 x 48 ctm. **51.00**
Per quire **3.00**

The same in round filters, 100 filters in a package, five packages in a box of birch bark.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.30**	**0.39**	**0.60**	**0.78**	**0.93**	**1.20**	**1.59**

All of the above-named filter papers are put up in the most careful manner, each package of 500 filters being enclosed in a birch box, preventing injury from dust or moisture, and affording a perfect container for it in the laboratory.

1818. **No. 3. A Pure White Paper of Superior Quality**—Heavier than No. 2, filters rapidly. Fully equal to any of the best German papers, but at less cost than any other paper of same quality and weight.

Per ream of 480 sheets; size, 48 x 48 ctm. **42.00**
Per quire **2.40**

Also in round filters, 100 filters in a package.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.24**	**0.30**	**0.45**	**0.54**	**0.72**	**0.96**	**1.23**

1820. **No. 100. Extra Heavy**—This grade is added to supply a heavier and stronger filter for certain solutions. It is of the same quality paper, as the above, filters rapidly, and will retain the finest precipitates.

Per ream of 480 sheets; size, 48 x 48 ctm. **60.00**
Per quire **3.60**

The same in round filters, 100 filters in a package.

Diameter, ctm.	5.5	7	9	11	12.5	15	18.5
Per 100 filters	**$0.33**	**0.42**	**0.63**	**0.81**	**0.99**	**1.29**	**1.65**

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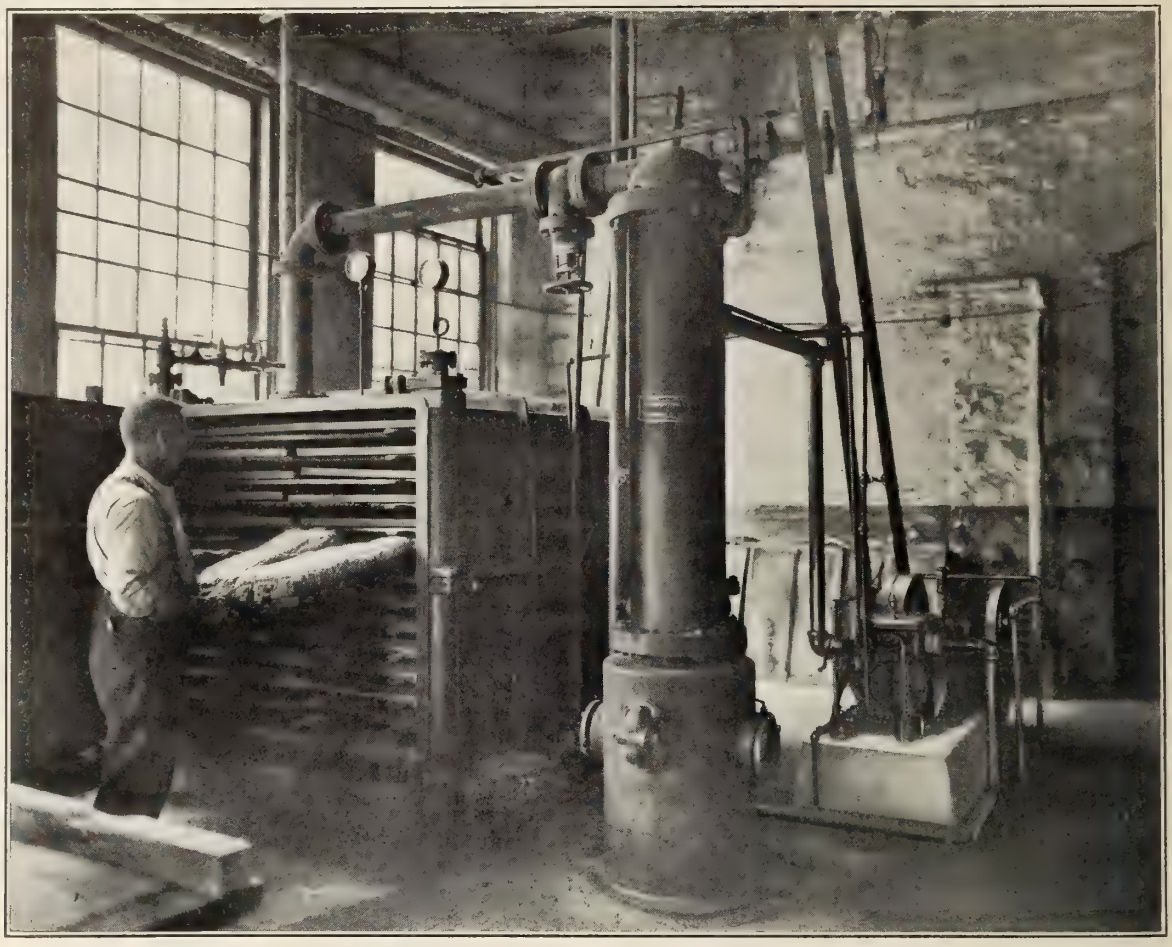

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Devine Vacuum Chamber Dryers are unexcelled for drying any materials that can be handled on trays or pans. The drying takes place at a very low temperature due to the high vacuum maintained. This low temperature prevents any chemical reaction, discoloration, or oxidation.

We will be pleased to send you our Bulletin 101-A on Vacuum Chamber Dryers.

BOOTHS 80, 121, 122
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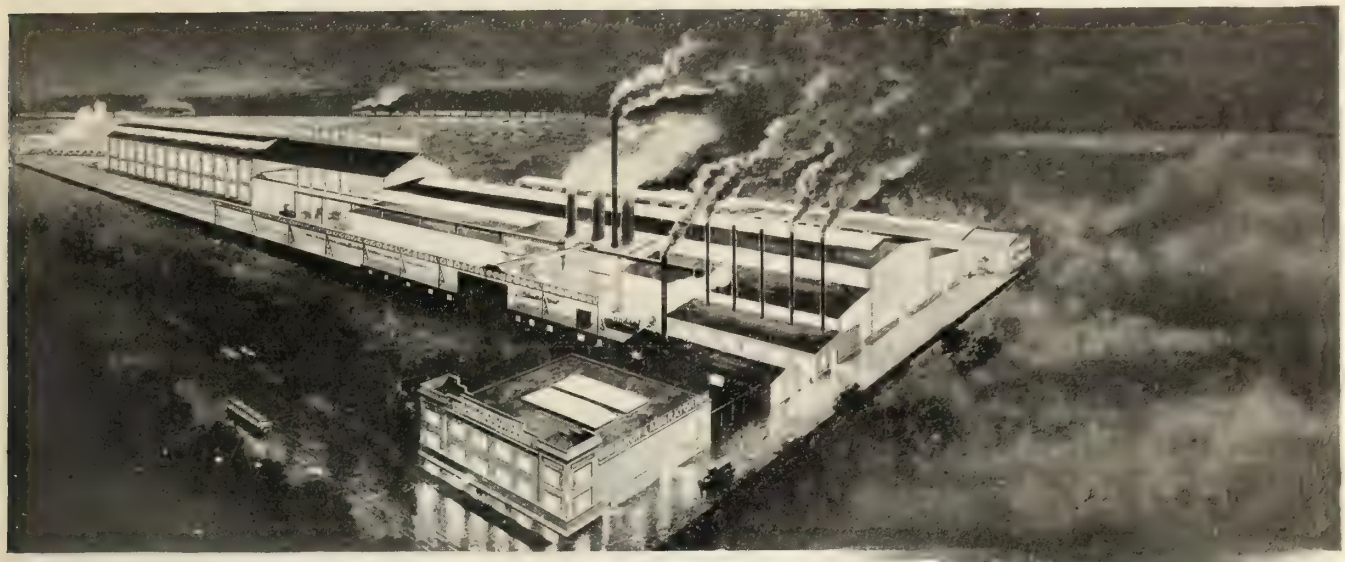

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WEEK OF
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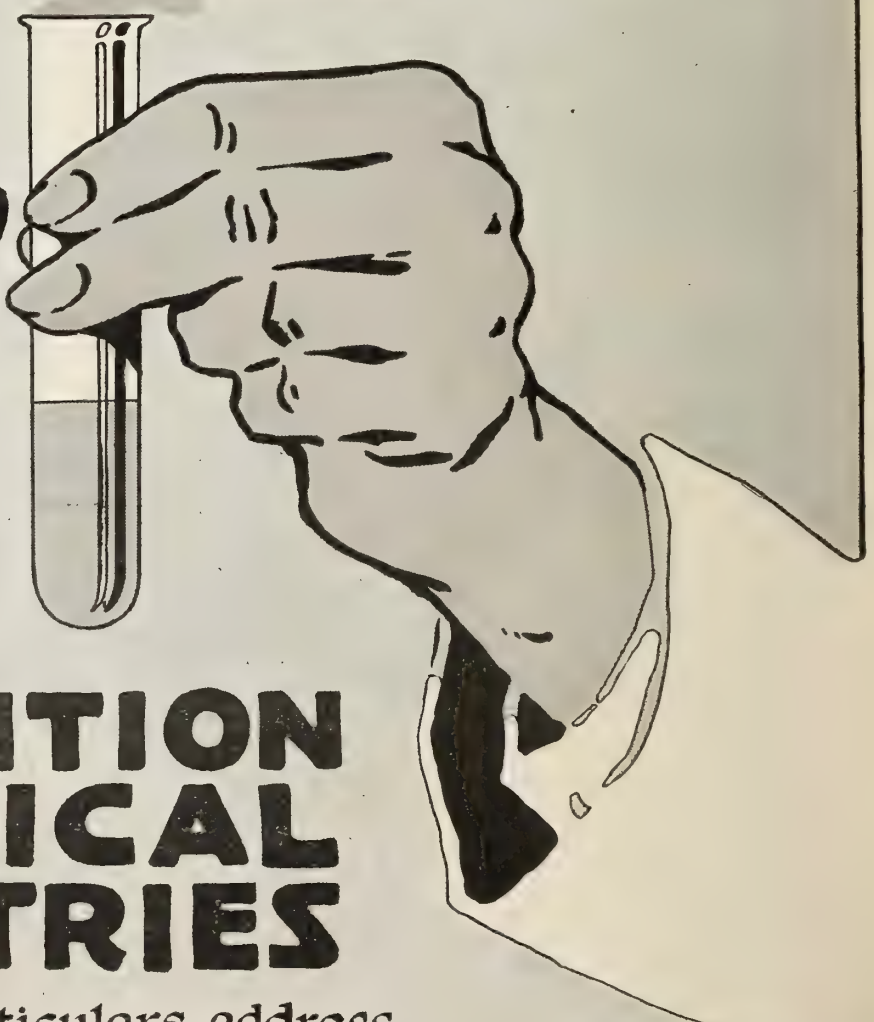

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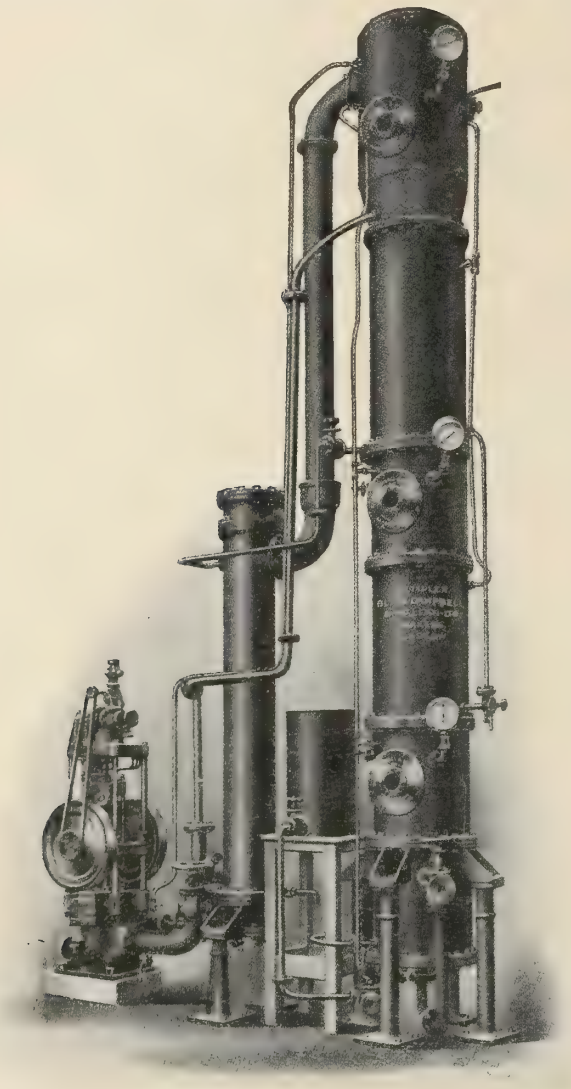

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Filter Problem Solved
at the
U.S. Ammonium Nitrate Plant
by

Monel metal

Continuous Operation Made Possible

TO eliminate shut-downs, MONEL Metal screens were used for supporting the filter cloth and MONEL Metal wire for winding the drums of the 20 Oliver Continuous Filters at the U.S. Ammonium Nitrate Plant, Perryville, Maryland. The action of the liquor was so severe that screens made of iron, copper, or practically any other metal, could not be used.

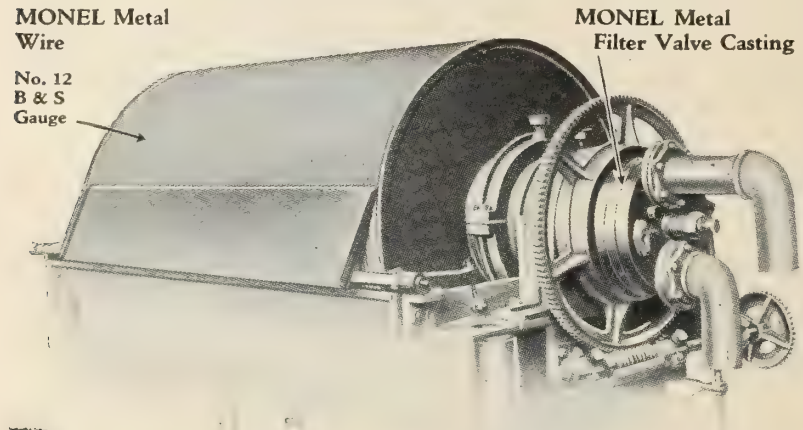
MONEL Metal wire, wound spirally over wool fabric (see illustration), gave permanent service. One MONEL wire, taken off and rewound over new fabric nine times, was still in perfect condition for further use. This is a typical example of MONEL Metal's wonderful resistance to acids and its superiority over other metals for equipment used in the chemical field.

MONEL Metal is very generally employed in manufacturing parts of bleaching and scouring machinery and dye-house equipment which come in contact with acids or strongly alkaline solutions.

MONEL Metal is a natural alloy of nickel and copper—strong as steel—tough and ductile. Withstands acids, high temperatures and erosive action of hot gases and superheated steam. Can be machined, cast, forged, brazed, soldered and welded by electric or oxy-acetylene method. Takes and retains a perfect nickel finish.

MONEL Metal is manufactured in the form of rods, castings, forgings, wire strip stock, sheets, etc. Some of its common uses, other than chemical, are valve trim, pump rods, pump liners, auto fittings and parts, pickling pins, mine screens, marine parts and fittings, oil and gas machinery and storage battery casings. The MONEL booklets show the many uses for which MONEL Metal has proved superior.

Write us for detailed information as to whether MONEL Metal could be substituted with economy and greater satisfaction than the material you are now using. Our Technical and Research Department is at your service. Address:



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Metallic Iron, 52% to 53%

Silica, 11% to 12%

Phosphorus, .75% to .80%

Ore piers are situated at Wabana, on Bell Island, Conception Bay, Newfoundland. Steamers have been loaded at a rate of over 2,000 tons per hour.

Address all inquiries to

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NEW GLASGOW, NOVA SCOTIA

MINING OPPORTUNITIES IN NORTHERN MANITOBA

Mineral Areas

Approximately three-fifths of the total area of Manitoba is Pre-Cambrian, and all but a small part lies in Northern Manitoba. In the Pre-Cambrian in Ontario, the well-known camps of Sudbury, Cobalt and Porcupine have been developed. In Northern Manitoba there was practically no prospecting until the Hudson Bay Railway gave access to the mineral districts. There are three fields in particular to which attention is now directed—The Pas Mineral Belt, the Cross and Pipestone Lakes area, and the Oxford Lake, Knee Lake, God's Lake and Island Lake area.

Development

Since 1915, development has been rapid in The Pas Mineral Belt. Twenty million tons of low-grade copper ore have been explored by diamond drilling at Flin-Flon Lake. High-grade copper is exported from Schist Lake to the smelter at Trail, B.C.; three and three-quarter million pounds of copper have already been realized. Copper prospects are under development on Athapapuskow Lake, Copper Lake and Brunne Lake. The building of a smelter will give impetus to the development of a large copper industry. Gold is now produced at Wekusko Lake, and important discoveries have been made on Copper Lake, and on Knee Lake on the Hayes River route.

Transportation

Transportation is available by the Hudson Bay Railway, by the Ross Navigation Co. Steamboats on the Saskatchewan River, and by wagon roads built into the producing areas by the Manitoba Government. Wekusko Lake may be reached in less than one day from The Pas. The Hudson Bay Railway gives easy access to several promising districts where little prospecting has yet been done.

Mining Regulations

The mineral resources are under Federal control, and the Dominion Mining Laws apply to Northern Manitoba. No mining license is required. Work to the value of $100 per year must be performed for a period of five years on claims filed under the quartz mining regulations. The office of the Mining Recorder for Northern Manitoba is at The Pas.

Opportunities for Capital

The district is comparatively new, and there are several very promising properties which may be acquired at reasonable prices. Financial and mining companies would be well advised to have their engineers inspect these properties at an early date.

For maps, reports and general information, apply to

The Commissioner of Northern Manitoba,

The Pas, Manitoba

ONTARIO'S RESOURCES

PROVINCE OF ONTARIO
DEPARTMENT OF LANDS, FORESTS & MINES
BUREAU OF MINES

G. H. Ferguson, Minister

See exhibit at the Coliseum, Chicago, week of September 22, 1919.

The area of Ontario, 407,262 square miles, is nearly as great as that of the states of Texas and California combined. About 70 per cent. of this area is pre-Cambrian in age, and embraces such well-known mineral regions as the Cobalt and Gowganda silver camps, the Sudbury nickel-copper area and the Porcupine and Kirkland Lake gold camps. Vast areas still remain to be prospected. Ontario's forest and mineral products are of special interest to the chemical and metallurgical industry of America, and offer inviting opportunities for the investment of capital.

Forests: Pulpwoods in abundance afford the raw material for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: Practically all minerals, with the exception of coal and tin, are found in the premier mineral province of Canada. *In* 1918 *Ontario produced* 45 *per cent. of the total mineral output of Canada.* Complete figures of output for 1918, as compiled by the Ontario Bureau of Mines, show a valuation of $80,308,972. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:—

Silver	$185,027,590	Nickel	$138,010,542
Pig Iron	78,925,917	Gold	50,864,863
Copper	49,947,080	Cobalt	5,918,899

MINERAL STATISTICS OF ONTARIO FOR 1918.

METALLIC.

Product.	Quantity.	Value.
Gold ..... ounces	411,878	$ 8,502,480
Silver ..... "	17,738,153	17,415,882
Copper ..... lbs.	1,211,922	270,430
Copper in matte (a) ..... tons	22,951	8,262,360
Nickel in matte (a) ..... "	44,297	26,578,200
Iron ore, exported (b) .... "	107,273	624,364
Iron, pig (c) ..... "	50,072	1,364,736
Cobalt, metallic ..... lbs.	404,348	887,960
Cobalt oxide ..... "	477,583	727,170
Nickel oxide ..... "	406	106
Nickel, metallic ..... "	3,450,550	1,262,116
Other nickel and cobalt compounds ..... "	453,515	73,347
Lead, pig ..... "	1,670,251	149,841
Molybdenite, concentrates "	47,614	59,067
Total metallic		$66,178,059

NON-METALLIC.

Product.	Quantity.	Value.
Actinolite ..... tons	228	$ 2,508
Arsenic, crude and white.. lbs.	5,090,818	566,332
Barite ..... tons	60	900
Brick, fancy and pressed. M.	25,377	396,698
Brick, common ..... "	49,498	665,454
Brick, sand-lime ..... "	7,941	91,508
Cement, Portland ..... bbl.	1,226,244	$1,910,839
Corundum ..... tons	137	26,120
Feldspar ..... "	19,784	111,173
Fluorspar ..... "	7,286	153,190
Graphite, crude and refined "	2,934	208,848
Gypsum, crushed, ground and calcined ..... "	38,214	151,564
Iron pyrites ..... "	270,966	1,144,737
Lime ..... bush.	2,650,285	872,177
Mica ..... tons	275	49,575
Mineral water ..... Imp. gals.	298,498	133,808
Natural gas ..... M. cu. ft.	13,075,742	2,498,769
Petroleum, crude .... Imp. gals.	10,106,615	781,097
Pottery		88,275
Quartz ..... tons	213,420	452,711
Salt ..... "	131,726	1,287,039
Sand and gravel ..... cu. yds.	1,023,497	553,638
Sewer pipe		362,536
Stone, b'ld'g, trap, granite, etc		869,239
Talc, crude and ground ... tons	17,465	246,691
Tile, drain ..... M.	13,087	309,899
Tile, hollow building		195,588
Total non-metallic		$14,130,913
Add metallic		66,178,059
Grand total		$80,308,972

(a) Copper and nickel in the matte valued at 18 and 30 cents per pound respectively.
(b) Total shipments of iron ore, 198,882 tons;
(c) Production from Ontario ore only; total pig iron, 751,650 tons, value $20,522,356.

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EDITORIALS

THE CHEMISTRY OF A NATION.

THE National Exposition of Chemical Industries has become the most outstanding event of the year in the technical and industrial world of the United States. The Fifth Exposition is about to be held this month at Chicago.

In England and the Continent, the idea has developed and records of various Empire and continental trade gatherings have all demonstrated the soundness of the principles upon which such efforts are based. The possibility of holding such gatherings, where papers are given on technical problems and successes, and where machinery and products are shown, rests upon a changed attitude of mind that has gradually come over manufacturers in general. Instead of locking up their men and limiting their intercourse with others, it has been found that both the individual and general advance is much better fostered by a free intercourse of ideas supplemented by travel and observation.

The first chemical exposition in America was held in New York in 1915. It was the result of an idea long in the minds of a few which became feasible with the new era for chemistry opened by the war. Analysts were forced to become chemical engineers, and progressive men were able to initiate the exposition idea at a time when failure was hardly possible. Sixty-three thousand people reviewed the efforts of eighty-three exhibitors at the first exposition in Grand Central Palace. Each year has seen development. The number of exhibitors has increased by hundreds, the interest shown by individuals has been more than sustained, and the program has grown in magnitude and variety, until it covers the whole front line in all sections of chemical advance in the United States and Canada.

A more happy blending of the extremely practical things of science could not be readily realized. Machinery of general and special value to dozens of industries may be studied and observed under the most favorable conditions. Purchasing agents and managers have opportunities for comparative study not readily obtained in any other way. The man whose opportunities have been found in special lines of work, whether in research, teaching, plant management, or analysis, will meet a broadening stimulus during the week that will remain with him throughout his year's work.

This year the program has been so extended that there will be something of paramount interest to everyone. In general, it will be the largest gathering of chemists ever held in the United States. It will also bring together the greatest number of mining and metallurgical engineers.

In previous years, many Canadians have visited New York at this time, but full advantage of the opportunity has not been made. Those who have attended have done much to increase the number who will be present at Chicago this year. For those Canadians who have the development of the raw materials of industry in charge, no better means of establishing relationships with American users could be thought of, while untold opportunities exist for publicity and the bringing of industries into the country. While the exposition is national in name, it is practically international in the sense that there is a distinct Canadian section where many Canadian raw products are shown as well as the products of leading Canadian chemical industries.

The program is given in detail in this issue, and we can assure all companies who have any doubt as to the wisdom of their being represented at the exhibition that they should encourage as many as possible of their technical men to spend the week of September 22nd in Chicago.

THE POSSIBILITIES OF WHITE COAL.

SOME figures are worth remembering. Over a score of large electro-chemical industries are located around Niagara Falls. The total power of the Niagara River is five million horse-power, and at least one-half of this may be made available without destroying the natural beauty. This may all be used over again for an equal development before it reaches Montreal. Other rivers in every province duplicate this situation.

Hydro-electric power has so worked its way into Canadian industries that there are few, indeed, who do not begin to see its great possibilities. They may view these from various angles and whether or not private ownership is better than State operation, the fact remains that the whole future of Canadian industry is linked up to this factor in a most complicated manner. The man who produces iodoform electrically may have little in common with the farmer reading his paper by light from the same source of power, but they represent ramifications of the development.

Every province has been surveyed from the standpoint of power developments. The 1918 report of the Commission of Conservation on this subject pointed out that there were 565 electric generating plants in Canada, with an aggregate capacity of

2,107,713 horse-power. They supplied 752 distributing systems in 973 places. Grouped according to prime-movers we have:

270	Hydro-electric plants aggregating	1,806,618 h.p.
201	Steam plants aggregating	288,202 h.p.
49	Gas plants aggregating	8,157 h.p.
45	Oil or gasoline plants aggregating	4,766 h.p.
	Total	2,107,743 h.p.

With the greater efficiency in modern methods of burning fuels, there is no reason to think that their use in many localities will be discontinued. At the same time, it is very evident that hydro-electric power in Canada has not only helped us at a time when our man-power was lowest, but also when the importation of coal was most difficult.

Electro-chemical industries cannot help but thrive under such conditions and where electric power at reasonable rates is a deciding factor, nearly every province is in a position to compete for industries with any portion of the globe.

OUR UNDERGROUND INDUSTRIES.

GENERAL factors combine to make Canada a great producer of inorganic substances. The ice very carefully scraped the face of our northern hills, leaving the treasures of the world subject to accidental and definite discovery. Different geological conditions have left a variety of riches and every province has been remembered in the will. In the scorching heat of the bright day, it is a pleasant thing in the north country to throw a pail of water on the bare surface of an exposed vein and see the true gold show up "in place."

From mining, the path leads to metallurgy, and we are well on the way. The province of Manitoba may be considered as the latest to enter the field. During the war, and following the building of the railway to Hudson Bay, a new country was thrown open to the prospector. He has begun his work and much copper ore has already been shipped out. Indications now are favorable for the building of a smelter in the province. A stimulus to prospecting has been the discovery of very good gold showings.

The lack of useful iron ore within the Dominion has been a drawback to a certain extent. Newfoundland has solved the problem in the East, and it is possible that electric smelting may work out the question in the central and western provinces.

Ontario has become one of the wealthiest mineral-producing areas in the world, and is the banner province of the Dominion. There is every evidence of her holding this lead as further explorations are made. It is certainly inspiring to consider the magnitude of operations that may be based on these resources as the population grows.

The basic industries of agriculture may be expected to expand, and the land area open to successful cultivation is much greater than was originally thought. Canada has received both the best and the worst advertising of any country, unless it be Russia. In spite of these things, the scientific facts of the case are that we have, underneath the surface of this country, resources in coal, metals, raw products of industry, and probably oils, such as may be made the background of a most happy prosperity, if utilized as modern science has shown us the way.

THE DEVELOPMENT OF WOOD PRODUCTS.

A VERY short time ago, relatively, there were less than fifty pulp-mills in all Canada. We do not know, but we believe that at the time there were few, if any, chemists who were specially qualified to attack the problems connected with the growth of this industry. Now, however, the chemistry of wood products and in particular pulp and paper, offers to Canadian chemists not only one of the largest fields for actual employment, but also one of the most promising when matters related to research are considered.

Interest in technical education and the more scientific control of general plant operations has been greatly advanced by the Technical Section of the Pulp and Paper Association. We are not so confident that the Dominion Government or many of the leading pulp and paper manufacturers, who have reaped such a bountiful harvest from this great natural resource, have devoted either the proper amount of attention or money to the scientific advancement of the industry. As for the Dominion Government in particular, it cannot be said that they have shown any great amount of judgment in handling the Forest Products Laboratories in Montreal. Spasmodic efforts are not good enough, and we trust that no policy of retrenchment will allow a most excellent experimental plant to lie idle longer or a good staff to be broken up further. In the matter of reforestration, and forest protection, we are in a better position to know where we stand, and we realize better our great past losses and the tremendous task ahead. Some companies are now working their limits on a reasonable basis, more particularly in the Province of Quebec, but there is most certainly a time coming when greater efficiency and definite planning will be the only salvation of our wood products.

There is a very grave danger that history may point with turned-down thumbs at some of the things that have been done in the pulp and paper industries of America. The equivalent of 364,000 cords of wood was discharged from Canadian mills in 1916 as a useless waste. Some 350 authors, mostly chemists, are recorded in the literature as having remarks to make in this connection. Of course, there are great

difficulties to overcome and the prospect of large dividends may not be so great, but the burden of the work necessary to give exhaustive tests in large experimental plants would not greatly reduce the dividends of some of the leading companies. The people, as a whole, cannot be expected to work up a product for such a profitable industry. The industry itself owes more to a consideration of its waste products. The production of ethyl alcohol cheaply would be a boon indeed at the present time. It is estimated that our oil imports could be reduced by $4,000,000 per annum if we were in a position to use the alcohol in our waste sulphite liquors for combustion purposes.

While investors may be pleased with pulp and paper industries, it is no time either for the government or chemists with the various companies to cease urging for action along these lines. The elimination of waste is a national duty, and in this instance the prize of success is not a small consideration.

ONE OF THE FUNDAMENTALS.

CHEMISTRY is gradually rising. It has had no easy path and even yet it is not far along the way. There seems to be something that makes it very difficult for some industries to admit that, without chemists they would either cease to exist or remain stationary. Perhaps we need a chemists' strike or revolution by way of a reminder. Every little while it may be noted that a vision of things as they should be seems to dawn for a moment in the mind of some director of industry or politics. Immediately the heavy siege-guns of noisy research propaganda are brought into action. A general bombardment follows on the cheap basis of partially informed words, weakening to very minor sputterings when financial considerations are involved. Those with really sane, advanced ideas on research and industrial progress generally feel disappointed.

We have not thought of industry in terms of chemistry long enough. The writing on the wall is so large that the individual who is close can hardly see it from his small corner. Only by withdrawing a little will all the confusing minor things be obliterated and chemistry, the big, outstanding factor in modern progress, become visible.

THE ANNUAL MEETING OF SOCIETY OF CHEMICAL INDUSTRY AND INTERALLIED CHEMICAL CONFERENCE.

BOTH these events have passed and left their mark. Undoubtedly the British chemists are active in a way never shown before. One of the important advances has been made along lines of chemical engineering. Better men, and men with a broader grasp of industrial affairs in general have been developed and nothing of that British love for pure research has been lost. The idea has been grasped that it is not enough to place British names in history as discoverers; they must also be recorded as real developers of practical industries.

Six conferences were held at the annual meeting of the Society in London. Power plants in chemical works were treated by the engineering group, and Prof. Louis, as chairman, spoke on the English coal situation. Various grades of coal and electric power were taken up. This was the first meeting of this group.

As usual, the conference on dyestuffs and synthetic drugs was largely attended. Dr. H. Levinstein emphasized the great importance to the State of the color industries. His points were: (1) It is a key industry. (2) Its possession offers a guarantee of peace. (3) It gives an incentive to research. (4) Political importance in peaceful penetration. Mr. James Morton pointed out probable results of various lines of action, showing where unrestricted admission of German dyes would lead to. Strong appeals were made by Dr. M. O. Forster and Dr. W. R. Innes for the further production of photographic and laboratory chemicals.

The Chrome-Tanning Industry.

Everywhere the German hand was seen and Mr. F. H. Briggs pointed out that the backward condition of the industry in England was due to the large amount of the trade in raw skins within the Empire, which has gone to Germany. The idea of scientific research has at last reached tanners, and the future was bright indeed. Prof. McCandlish pointed out that the first successful commercial process for chrome-tanning (Schultz's process) was worked out in the United States. The large-scale operations of America placed them at some advantage in methods. Chrome uppers had been well tried and used in army boots, while English chrome sole leather was both very waterproof and durable.

Fermentation Industries.

The Weizmann process was well discussed, and Prof. A. Fernbach claimed priority for the discovery of the fermentation process for making acetone and butyl alcohol from starchy materials. His claim was supported by Sir F. Nathan. Toronto can claim the largest development of the Weizmann process, as, in 1918, the production of the modified Gooderham plant was 200 long tons per month of acetone, and the work done on the by-product, butyl alcohol, whereby bethyl ethyl ketone was produced, gives some added distinction to this plant. The production of acetone, however, in peace times, was considered as very likely to be left to the wood distillation plants, as they are best able to produce on normal prices.

The Interallied Chemical Federation.

Sir William Pope explained the decision to form an international scientific organization with the Central Powers excluded. The Allies do not need the dominating influence of further exhaustive German contributions to chemistry. They need rather to be aroused to the point where they will produce their own "Beilsteins" and cast off forever the idea of allowing Germany to receive the benefits of doing work that should be done in Allied countries. Delegates to the Interallied conference met in Salters' Hall, London. Proceedings were conducted in French with M. Moureu, of the French Institute, in the chair. Rules for a new body, "The International Confederation of Associations for Pure and Applied Chemistry," were drawn up. The officers elected for a three-year term were: President, M. Moureu; vice-president, M. Chavanne (Belgium), C. L. Parsons, Sir William Pope; secretary, M. Jean Gerard (49 rue des Mathurins, Paris). Neutral countries and British dominions may have separate representation and Poland and Canada have already signified their intention of taking this opportunity. General rules of organization were adopted, and it is proposed to hold the next conference in Italy in June, 1920.

Fuel Resources of Alberta

A Statement of Present World Conditions and a Summary of Lines for Development in This Province.

By R. D. MacLAURIN

THE creation by the Alberta Government of a Ministry of Industry is the outstanding recognition in Canada of the value of our natural resources and the urgency for immediate development as an economic measure. The record of the Hon. A. G. MacKay, the presiding Minister, insures a vigorous and constructive policy for the development of Alberta's vast potential wealth in coal, natural gas, petroleum and other mineral products.

The same vision which has characterized the creation of a Ministry of Industry is obviously inspired with a realization of the prerequisites for attaining the desired objective by contemplating the erection of an Industrial Research Laboratory thoroughly equipped and ably manned by specialists to secure the facts upon which to build the future industrial structure of the province.

If such a plan is consummated, the Alberta Government will stand out pre-eminently as the pioneer in the history of industrial development in the Dominion of Canada.

The urgent need for a progressive policy to secure increased production of essential mineral products is evidenced by the fact that Canada imported last year coal valued at seventy-one million dollars, petroleum products thirty million dollars, iron and steel products one hundred and seventy-seven million dollars, making a total of two hundred and seventy-eight million dollars, a sum which makes up the major portion of our adverse balance of trade. The importation of coal into Western Canada is as paradoxical as carrying coal to Newcastle, and is no more justifiable than would be the importation of wheat or live stock.

QUANTITY OF COAL.

The Dominion of Canada ranks second among the nations of the world as regards its potential coal resources, which have been estimated at 1,234,269 million tons, of which 1,059,927 million tons or 86 per cent. of the total is possessed by the Province of Alberta. Furthermore, the total coal in Great Britain and Ireland, Australia, India, South Africa, New Zealand, Rhodesia, Newfoundland, South Nigeria, British North Borneo, has been estimated at 494,916 million tons; consequently, according to the above figures, Alberta contains more than twice as much coal as Great Britain and her other possessions within the Empire. Such a bountiful heritage involves the responsibility of economically utilizing such resources for the benefit of the Dominion of Canada.

In order to more fully appreciate the national significance of coal, it may be advisable to refer briefly to the part which it has played in the constructive economic policies of certain countries.

GREAT BRITAIN.

Great Britain gained her position in the world's commerce very largely by reason of her plentiful supply of cheap coal which enabled her not only to pay for a considerable portion of imports, but exercised a very potent influence on inward freights of goods and raw materials by providing a useful and paying return cargo. The influence of cheap coal, cheap food and raw materials on works costs and manufacturing costs, is so obvious that it does not require emphasizing. To-day, Great Britain faces a national crisis in her coal trade, as is evidenced by a decrease in production of over 20 per cent. during the past five years, and also a decrease in exports during the same period of 56.7 per cent. Furthermore, the cost of production has increased to such an extent that successful competition with the United States in the South American and European market is endangered. However, the government is alert, as every attention is being concentrated on the reorganization of the coal industry, and many radical changes will be made in order to lower the cost of production so as to enable favorable competition with the United States.

GERMANY.

In order to visualize the national significance of coal in industrial Germany, it is necessary to understand the meaning of the distillation of coal, which process was made the chief cornerstone of her economic structure for peace and war. Crude coal tar formed the raw materials from which dyes, pharmaceutical and photographic materials are obtained and Germany gained control of the greater part of the world's trade in these chemicals. Furthermore, the same compounds used in making dyes, etc., are those from which explosives and poisonous gases are made, consequently Germany had the chemical plants, equipment and personnel for manufacturing unlimited quantities of the above materials. The coke and gas from the distillation of coal was used in the iron, steel and other metallurgical industries. The ammonia was used for fertilizers, the manufacture of nitrates, and other chemicals; consequently it is apparent that Germany prepared for peace and war by building up essential chemical industries, the products of which controlled the world's market in war materials, thus establishing a profitable foreign trade and at the same time preventing other countries from building up those fundamental industries and consequently being prepared for war.

During the war, the coal distillation process was necessarily extensively developed in England and also in the United States, so that now those countries are largely independent of German supplies in dyes and other chemicals, but the cost of production is still considerably higher than that of pre-war Germany.

Germany's commercial and military ethics remain the same, and she is relying on her chemical industries, which are much more powerful than before the war, as her peacetime submarine to fight her way into commercial society.

UNITED STATES.

The government of the United States recognizes as never before the national significance of coal, and has decided to seriously co-operate in the development of the coal industry.

A combination of the former British and German economic policies has been adopted by the United States, which is evidenced by an increase of 243 per cent. in her coal export to Europe and 350 per cent. to South America. National industries, utilizing the products of coal distillation, have been established at an expenditure of hundreds of millions of dollars, and which, undoubtedly, will be protected by a license system. As the United States possesses 51 per cent. of the world's total supply of coal, and produced last year 685,000,000 tons, while all the other countries in the world,

outside of Great Britain, produced only 500,000,000 tons, it is obvious that the United States will occupy a strategic position in the world's trade.

As already pointed out, however, Canada ranks second in coal resources, of which Alberta possesses 86 per cent., and as the vital national significance of coal in certain countries has been incontrovertibly established, it should be apparent that Alberta is destined to become one of the chief industrial centres in Canada. The responsibility for laying the organized foundations for that future industrial edifice of national independence and security challenges our courage, confidence and grasp of the potentialities of our own country.

METHODS OF USING COAL.

The successful marketing of Alberta coal at the present time depends upon efficient methods of mining, efficient combustion and satisfactory methods of storage. A considerable prejudice exists in Manitoba and Southern Saskatchewan against the use of Alberta coal for domestic purposes, and such a condition must be overcome by demonstrating how the various coals may be burned to the best advantage.

It is a well-known fact that a large percentage of coal, especially that with high volatile content, is wasted through inefficient methods, consequently investigations should be conducted with the object of determining the conditions under which the best combustion results can be obtained, both for domestic and commercial purposes. A conservative statement of the waste due to incomplete combustion is 25 per cent., so the waste would be 1,500,000 tons, conservatively valued at $7,000,000. It is apparent that expenditure of money in an organized effort to bring about a practicable efficiency in the use of coal in domestic and power plants is not only justifiable but imperative.

POWDERED COAL.

Powdered coal is coal which has been dried, crushed and powdered to an impalpable powder. As a result of powdering, the surface of the coal is increased about 700 times, so that when mixed with air and fed into the furnace the mixture burns and can be controlled as readily as burning gas or oil. Powdered coal is used successfully in the manufacture of cement, in the iron and steel industry, in the production of copper, and in the generation of power. Powdered coal has many advantages: (1) It is smokeless; (2) less air is needed, thereby reducing stack losses; (3) all the combustible is consumed; (4) flexibility in operation; (5) almost any kind of coal can be burned; (6) reduces troubles connected with clinkering; (7) cost of preparation ranges from 20 to 60 cents per ton, which is not excessive. The use of powdered coal is based on sound scientific principles, and permits the economic utilization of a wide variety of coals.

CARBONIZATION.

Carbonization is the most economical method of utilizing coal, providing conditions are favorable for marketing the by-products. The products of carbonization are: Coke, gas, tar, ammonia, benzol, toluol, xylol and naphtha.

The coke and gas can be used for domestic, power or metallurgical purposes. The ammonia liquor may be converted into ammonium sulphate for fertilizer purposes, or oxidized to nitric acid, or used in the form of a dry gas for refrigerator purposes or as aqua ammonia for household use.

The tar may be used as fuel but the most economical method of handling the tar is to distil it and recover the benzol, toluol, xylol, naphtha, the carbolic oils, creosote, naphthalene and pitch.

The lighter fractions can be used as motor fuel, and also these same compounds can be used for making dyes, pharmaceuticals, photographic materials, explosives, poisonous gases, etc.

The creosote is valuable for preserving ties, naphthalene for dyes, disinfectants, etc., and various forms of pitch for road-making, roofing and as a binder for briquettes.

Carbonizing should be conducted in by-product coke ovens as the bee-hive oven is primitive, crude and wasteful. As the recovery of by-products from coal was an essential war industry every effort was made to improve the process so as to obtain the maximum yield of compounds used in the manufacture of explosives and poisonous gases.

The delayed recognition of the merits of the by-product coke-oven industry had resulted in enormous waste. Mr. Frank Marguard, of the By-Product Coke Plant, Clairton, Pa., states that "during the past twenty-five years in the United States the waste resulting from the use of bee-hive ovens in tar and gas, reduced to coal equivalent, was over 300,000,000 tons of coal, and a waste of over $400,000,000 worth of ammonia and over $500,000,000 worth of benzol products, these conservative amounts being based in each case on subnormal prices." It is now recognized by the British and United States governments that the by-products coke industry is one of the chief weapons of national defence and safety. Germany's economic and military power emanated from this industry, and it should be pointed out that Alberta possesses three times as much coal as Germany in Europe, and has a larger area, so the industrial opportunities in Alberta should be apparent.

NATURAL GAS.

The national significance of natural gas remains to be revealed by the chemist, for during the past it has been used almost exclusively as a fuel, but the time will soon come when natural gas will be much more valuable as raw material from which many chemical industries will be created than it will be for fuel.

Four years ago the writer, assisted by Dr. Thorvaldson, conducted experiments at Medicine Hat on natural gas, with the object of synthesizing it into the higher paraffins or aromatic compounds. The results obtained were encouraging and undoubtedly there is a promising future for such investigations. By oxidizing natural gas, formaldehyde and methyl alcohol can be obtained. The manufacture of formaldehyde (formalin) is an industry which should be established in Alberta, as a large quantity of it is used every season by the farmers of Western Canada. The loss due to smut every year amounts to many millions of dollars, and formalin should be used to a much larger extent than it is. The raw materials are available to manufacture sufficient to supply at least the Western market.

The reported salt deposits in Alberta, if sufficiently large, will supply the raw material for important chemical industries as soon as market conditions warrant them, but in the meantime the territory should be thoroughly tested, and also brine waters analyzed which are obtained from oil and gas wells.

A large salt deposit with abundance of coal and limestone will mean the manufacture of innumerable soda, ammonium and calcium compounds. When salt is electrolyzed, caustic soda is formed and also chlorine, which could be used for chlorinating natural gas, forming chloroform,

carbon, tetrachloride and ethylene dichloride. Such is a forecast of the future chemical industries which will be established to utilize and market the raw material now available.

The natural gas from the Bow Island field contains about one per cent. of helium, which, owing to its chemical properties, has been used in dirigible balloons. Professor MacLennan, of the University of Toronto, states that at the present time the helium passing up the chimneys of Calgary has a value of $100,000 a day. As a great many chemical reactions are conducted in an inert atmosphere, helium may prove more suitable than gases formerly used. It is imperative that investigations should be intensively continued on this important element, so as to find a market for it. A study of the properties of elements at high and low temperatures in an atmosphere of helium will reveal properties of matter never dreamed of heretofore. A representative of the Bureau of Mines, Washington, is in Europe at the present time with the object of securing information as to the available market for helium, consequently it is very important that a market should be secured and enlarged for the helium from the Calgary plant.

It is impossible to overemphasize the urgency for research on natural gas in the Province of Alberta, especially in view of the prospective extensive operations in developing an oil field. The pertinent question will be, What is the gas to be utilized for?

Five important gas fields have been developed in Alberta, Medicine Hat, Bow Island, Viking, Pelican and Peace River. In 1917 the production of natural gas in Alberta was 6,744 million cubic feet, valued at $1,299,976 as sold by producing companies.

The history of the natural gas industry in the United States is an appalling record of incredible waste, and as the supply of gas is not inexhaustible it is the duty of the government to provide facilities for inspecting gas production and further research in regard to the use of this important substance.

The importance of conserving natural gas can hardly be overestimated for the following reasons:

(1) Natural gas is the cheapest and best fuel known.

(2) Cities and towns adjacent to gas fields have provided themselves with facilities for using gas.

(3) Large amount of money spent in piping gas and industrial plants.

(4) Wealth of any province is determined by the quantity of resources and the scientific methods employed to utilize them.

(5) If wells are left open the rock pressure is lowered, thus allowing water to rise and stop the flow of gas from other wells.

(6) Utilization of natural gas as raw material for many chemical industries.

NATIONAL SIGNIFICANCE OF OIL.

Profiting by the costly experience of the war, the British Government has determined to secure a permanent supply of oil for the navy and industrial purposes, and be independent of foreign supplies. It has been reported that the British Government has adopted a clearly defined policy, and is credited with financing what is expected to develop into the most powerful oil-producing, refining and transporting enterprise in the history of the industry. An oil ministry has been created which will have control over concessions for the development of possible oil territory within the Empire, and will advise and assist British companies outside the Empire.

Canada imports about 98 per cent. of her petroleum products, and as the most promising surface indications for the development of a large oil field in Canada are in Northern Alberta and the North-West Territories, the time is urgent for the serious consideration of the most satisfactory policy to be adopted in that regard. The production of petroleum is a scientific business, and it is not in the national interest to depend upon a hit-or-miss plan of exploitation.

The refining of petroleum has been greatly improved during the past five years, and many new by-products have found commercial use during that time. The common by-products of petroleum are gasoline, kerosene, fuel oil, lubricating oil, vaseline, paraffin, road oil, asphalt, pertoleum, coke, etc. Some of these substances have been used as the starting-point for the manufacture of a few hundred compounds of commercial value, but the mind cannot place any limit to the number of useful materials that chemical research may discover from this raw material. The opportunity of constructing a great oil by-products industry, rivaling, if not exceeding, the coal by-products industry, confronts the chemist.

In view of the importance to which petroleum has attained in the struggle for trade supremacy, it is regrettable that the vast prospective oil territory of Northern Alberta receives such scant publicity and attention. Concerted action to bring the potentialities of that territory before the financial world should at once be taken. The development of a commercial oil field in Western Canada would, by the creation of vast wealth, insure the development of other resources, and the key-note to rapid industrial progress is oil production. Now is the time to formulate plans judiciously, as Alberta is destined to be one of the greatest industrial provinces in the Dominion.

Department of Chemistry,
University of Saskatchewan,
Saskatoon, Sask., July, 1919.

CHEMICAL TRADE OF ENGLAND IN MAY.

During the month of May, 1919, the export trade in chemicals, drugs, dyes and colors, of Great Britain, although below the level of the April returns, maintained the progressive movement of the spring months. In May, 1919, the export of chemicals and allied products from Great Britain were valued at $12,840,730 against $11,129,665 in May, 1918, an increase of $1,711,065. Shipments of bleaching powder out of England have steadily increased and were 44,711 cwt. in May, 1919, compared with 36,097 cwt. in April and 10,006 cwt. in May, 1918. Foreign trade in sulphate of copper, however, fell off sharply, the exports for May totalling only 4,797 tons compared with 10,000 tons for April. Export trade in some of the coal-tar products, especially pitch, tar oil and creosote, appears very much better, and the same is true of sulphate of ammonia, of which 3,000 tons were exported in May, 1919, compared with 545 tons in May 1918. White lead increased from 638 cwt. May, 1918, to 24,677 cwt. May, 1919. Zinc oxide from 64 cwt. to 2,086 cwt. Only one item failed to increase in export in the soda compounds, namely, chromate and bichromate of soda; all the others, including soda ash, show substantial increases.

On the Oxidation of Phenols by Gaseous Oxygen and the Catalytic Effect of Metals.

By F. W. SKIRROW*

THE present communication consists of a preliminary account of experiments which have been carried out intermittently during the last two or three years, and which are still in progress.

In connection with a technical study of the distillation of phenols and the best metal to use for still-head and condenser, many years ago the writer bottled up samples of cresols with various metals, in order to ascertain which of the metals had the least effect in discoloring the cresols. It was then noticed that a partial vacuum invariably developed in the bottle after standing for some time, but this phase of the matter was not subjected to further study at that time.

In a paper which appeared recently in the Journal of the Society of Chemical Industry, Williams and Seligman investigated the action of various organic substances on aluminum, and found that there is a very general action by a great variety of substances when the substances are dry, but that small amounts of water inhibit the action in a remarkable way.

In this work Williams usually worked at an elevated temperature, but states that in the case of phenol, for example, the corrosive action extends down to the temperature of solidification of the phenol. He, however, did not give much attention to the simultaneous action of the oxygen of the air, although his experiments were carried out in open vessels.

In the present series of experiments, copper was the metal chosen for study, and the phenol or cresol were used chiefly in dilute solution in pure dry benzene.

If a piece of copper be placed in a pure solution of phenol or cresol, and exposed to the air, a dark brown coloration rapidly develops, and in two or three days the solution becomes almost black and opaque.

Preliminary Experiments with Ortho Cresol.

In these experiments pieces of pure copper foil, two inches by four inches, were placed in glass tubes of about three-quarters-inch diameter and six inches long, which were held in a vertical position, and to the bottom of which a bent glass tube was fused, through which the cresol or cresol solution could be introduced and then sealed off before the blowpipe. To the upper end of the wide tube a small mercury manometer was sealed, to indicate the rate of absorption of the gas, which, in the first experiments, was air. The following list of variations was made in the tubes:

(1) 10 c.c. pure O. cresol. Copper completely submerged.

(2) 10 c.c. pure O. cresol. Copper half in liquid, half in gas.

(3) 10 c.c. 5% cresol solution in benzene. Copper submerged.

(4) 10 c.c. 5% cresol solution in benzene. Copper half emergent.

It was found that in all cases the rate of drop in pressure was slow for the first day, became quicker the second day, reaching a maximum rate which was maintained for about three days more, then slowing down and falling to zero about the fourteenth day. The rates in all were substantially identical or showed no regular differences in the four cases.

The figures for one set will typify the behavior of the other three:

Time in days—	0	1	3	4	5	6	14
Drop in pressure per day for the interval	0 mm.	8.5 mm.	20.5 mm.	29 mm.	33 mm.	11 mm.	2.5 mm.

The total drop in pressure for the four cases in fourteen days was as follows:

1	2	3	4
131 mm.	124 mm.	127 mm.	128 mm.

By the fourteenth day each of the tubes had become dark brown in color, but no further darkening was observed after six months' standing.

In a parallel tube was placed a piece of copper foil of equal surface and a 5% O. cresol solution, but this tube was evacuated and boiled out two or three times to remove all dissolved oxygen, and the tube then filled with pure nitrogen. In this case no drop in pressure was observed or expected, but the cresol in this tube did not darken at all, and, in fact, after three years' exposure to the ordinary light of the laboratory, is as clear as the day on which the tube was filled. It appears certain, then, that the action of cresol on copper and the consequent discoloration of the cresol depends entirely on the simultaneous absorption of oxygen, and it is questionable (though this point has not been actually tested) whether the cresol has any action on copper in absence of air.

Experiments with Oxygen.

The next experiment was carried out with a larger amount of O. cresol. 4.5 gr. of O. cresol was dissolved in 100 c.c. benzene and the solution placed in a 250 c.c. distilling flask along with pieces of pure copper foil weighing 1.18 gr. and with a surface exposed of 130 cm².

This was boiled out to expel air, which was then replaced by oxygen from a cyclinder, which was first dried through H_2SO_4, and the apparatus shaken until the solution was saturated with the gas at the atmospheric pressure.

The side tube of this flask was sealed to a gas burette containing oxygen over mercury and provided with a three-way cock, through which fresh oxygen could be admitted as required.

The apparatus was maintained at a uniform temperature, and the total volume of oxygen absorbed read off from time to time.

The gas was saturated with benzene and the observed volumes of oxygen were corrected for pressure and temperature, due allowance being made for the vapor pres-

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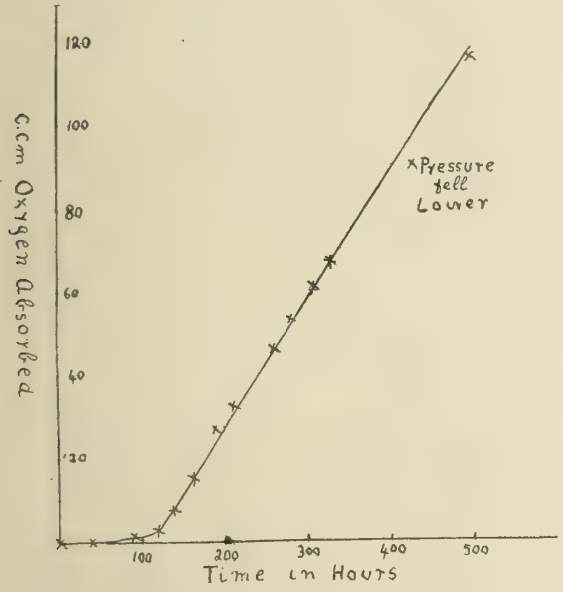
sure of benzene. The following table gives the results obtained:

Total time from start, in hours.	Total oxygen absorbed, c.c.
0	0
43	0
91	1.1
118	2.5
140	7.3
162	15.4
192	27.0
211	32.6
259	46.0
282	53.2
307	60.6
331	67.3
428	89.5
500	116.4
836	194.1
1,267	246.8
1,337	250.7

The figure shows these results graphically up to 500 hours.



From the figures it will be seen that there is a considerable initial lag.

At first there was very little absorption of oxygen, but after 100 hours the rate of absorption began to increase, and at about 120 hours attained a steady rate of some seven c.c. per day, which was maintained unchanged for three or four weeks.

At the end of that time the rate again began to fall off, becoming quite small about the fiftieth day. (These latter points are not shown on the figure.) When this slowing up had become very great the gas was pumped out of the apparatus and analysed, and it was found that there had been a considerable accumulation of inert gas, probably from impurities in the oxygen used. When this inert gas was replaced again by fresh oxygen the rate of absorption rose again to its previous value.

The initial lag appears to point to one of two things—either the production of a substance which acts as a catalyst to the reaction, or the destruction of some substance which initially retards the absorption. In either case, when this is achieved, the absorption assumes a steady rate for a very considerable time.

On examination of the dark liquid in the flask it was found that a few drops of liquid, immiscible with benzene, had separated, and that a small amount of apple-green crystals had deposited. There was not enough of these crystals for extended examination, but they were filtered off and washed with benzene. They were then air-dried, and a small portion was further dried at 100°, showing a further loss of weight. These samples were then ignited in air (they were highly combustible), and the black residue further dissolved in nitric acid, re-evaporated and again ignited, giving copper oxide.

The percentages of copper found were as follows:

Calc. on the air-dried material ..... 40.4% Cu.

Calc. on the material dried at 100° ..... 44.9 " "

These results seem remarkably high in the light of the following percentages of possible compounds:

Copper cresylate $(C_7H_7O)_2$ Cu. ..... 22.9% Cu.

Copper salicylate $(C_6H_4(OH)COO)_2$ Cu. ..... 18.8 " "

Or possibly $C_6H_4 \begin{matrix} COO \\ O \end{matrix}$ Cu. ..... 31.8 " "

whilst cuprous cresylate C_7H_7O Cu. ..... 37.2 " "

The latter seems hardly likely in a medium saturated with oxygen.

It is possible that the results point to some fission of the benzene ring in the course of the absorption. An apparatus has been constructed to work with oxygen under 300 pounds pressure, and it is hoped to be able in this to speed up the reactions involved and, incidentally, to obtain a much larger amount of this crystalline substance for examination.

Further Experiments with Ortho Cresol.

In an attempt to ascertain the cause of the initial lag in absorption, two experiments were set up, as follows:

(1) A benzene solution of ortho cresol was placed in the flask containing copper, and with the air completely replaced by pure nitrogen, and this left for eleven weeks. The nitrogen was then pumped out and replaced by oxygen from potassium chlorate. In this case there was no very definite initial lag, but the rate was never more than one-quarter of the rate in the preceding case recorded. It was thought that this might be due to some trace of injurious impurity from the potassium chlorate, or that moisture had leaked into the stop-cock of the apparatus, which in this experiment was submerged in the thermostat, and this might inhibit the action, as in Williams' experiments.

In another experiment the surface of the copper was first covered with a film of copper oxide by passing through a flame. The rates of absorption here were very small, the surface of the copper being apparently permanently injured, and the absorption not being greater than 1 c.c. per day.

The copper oxide was not dissolved by the cresol, small flakes of it remaining unchanged after forty days.

Two parallel experiments, in one of which the copper surface was double that of the other, both showed the initial lag and also showed that the rate with the larger surface of copper was very much greater than with the smaller surface. These were also carried out with unpurified oxygen from potassium chlorate, and with the stop-cock submerged in the thermostat, and showed considerable variations in rate. Some unascertained factor again partially vitiated the results.

Preliminary tests carried out with pure electrolytic oxygen, purified from traces of ozone, seem to show that much

more consistent results will be obtained than with the unpurified oxygen from potassium chlorate.

Comparison of Ortho Cresol and Phenol.

In these experiments the reactions were carried out with much more concentrated solutions in order to speed up the absorption. The stop-cock in the bulb was also eliminated, and the whole apparatus placed in a large cupboard, which was kept at a definite temperature by an electrical thermostatic arrangement. Thus the possible effect of traces of water was eliminated. (All materials used in these and the foregoing experiments were always carefully purified and dried.)

In order to compare the rates with phenol and O. cresol, equivalent amounts (half the gram molecule weight) of each were dissolved in benzene and made up to 100 c.c. with pure dry benzene. The whole of this was placed in two precisely similar absorption flasks, and each flask sealed to an independent mercury oxygen burette. In each flask was placed pieces of copper foil, exposing equal surface (609.5 cm^2).

The two flasks were then boiled out to free them from air, and pure electrolytic oxygen introduced, and the solution shaken to quickly saturate it with oxygen.

The apparatus was then left quiescent and the rates of absorption noted. The following table gives the rates in c.c. per day for the two experiments:

	Rate Phenol.	Rate O. Cresol.
First day	4	12
Second day	7	36
Third day	10	108
Fourth day	12	139
Fifth day	15	155
Total	48	450

The first point to be noted is that the rate of absorption by O. cresol is very much larger than that by phenol, the total volume absorbed in five days being 48 c.c. for phenol and 450 c.c. for O. cresol, whilst the absorption on the fifth day by O. cresol is more than ten times the absorption by phenol. It was found, further, that the rates of absorption for O. cresol could be enormously increased by shaking, whilst that for phenol could be increased to only a relatively small extent. The reaction in the case of O. cresol proceeded much faster than the diffusion of the oxygen into the solution, whilst this was not nearly so marked in the case of phenol.

A second point which is evident is that in both cases a considerable initial lag in the absorption takes place, although here there was no period actually observed when no absorption could be detected, or if such period was existent it could only have extended over the first few hours of the run. The experiment was started at night and the first observations were taken the following morning.

The present paper is only offered as a preliminary notice. Many questions arise for solution. In the first place, we are quite in the dark as to the nature of the reactions which are taking place. Also as to the mechanism of the catalysis, the causes of the initial lag, the nature of the dark-colored compounds formed in solution, and of the green crystalline deposit which, at least, suggests a higher percentage of copper than is consistent with its being an aromatic compound.

It is proposed to study the other cresols as well as phenol, and also to find out the influence of other metals. It is hoped that, by working under pressure, the time consumed in getting workable amounts of the products formed may be greatly reduced, and that in this way it may be possible to isolate the product, or products, of the reaction, and to form a working hypothesis as to the role of the metal in the catalysis and as to the actual compound which brings about the increased absorption.

WANT INDEPENDENT CONTROL BOARD.

The Western Coal Operators' Association of Canada has presented a memorandum to the Industrial Relations Commission advocating the appointment of an independent board to take control of the coal industry in Western Canada. The memorandum states that such a board should be made up of one man, perfectly familiar with the problems of the operators; another man perfectly familiar with the problems of the workmen; and a third man with such qualifications and experience as would commend him to all as a reliable chairman. The mine operators are unanimous in the opinion that joint councils of employers and employed could not bring harmony to the industry at the present time as 85 per cent. of the miners are foreigners whose ignorance made them a prey to agitators. Mr. E. Mart, general manager of the Canadian Coal Company collieries, stated to the commission that the agitator who was actually earning from $10 to $20 per day, but who had no ordinary British subject responsibilities, was the man who was doing the most harm. The high cost of living in other lines, he agreed, had caused some of the unrest, but the only solution was a complete understanding of both parties. It might be difficult, but he was optimistic.

GASOLINE TANK WILL NOT LEAK.

A gasoline tank that will neither leak nor explode is described by the Scientific American as one of the important military secrets of the war. It is the invention of F. Weinberg, a Detroit engineer, and was perfected by the Bureau of Standards and the Science and Research of the War Department.

This tank is specially for use in military airplanes, as bullets do not make it leak nor do incendiary explosive bombs set its contents on fire. It is described as an ordinary nickel tank having two tubular connections and its filler cap. One of these tubes conveys the gasoline to the carburetor; through the other suction is produced by a venturi operated by the velocity of the plane, thus creating above the gasoline a partial vacuum that is sufficient to prevent the flow of liquid through any hole that may be shot in it.

The metal tank is covered with rubber, which to a large extent plugs up any hole. The tank may literally be made a sieve by hostile fire and yet refuse to leak.

To cause an explosion there must be a combustible mixture of air and fuel; but in the Weinberg tank no such mixture is possible. A bullet penetrating below the level of the liquid is at once smothered. A bullet penetrating above the liquid finds not enough air to produce combustion, for the venturi has taken care of that. In the one case the incendiary bullet is smothered by gasoline, in the other by nothing at all.

CONSUMPTION OF LEAD IN CANADA.

During the five years, 1910-14, the net consumption of lead in Canada averaged 31,000 tons a year, and increased in 1915 to 46,000 tons.

The Use of Benzol and Benzol Mixtures as Motor Fuel*

By I. C. MACKIE

THE recovery of crude benzol or light oil from coal gas was greatly extended and developed during the war, primarily for the sake of the toluol so obtained. The crude light oil consists of approximately 72% benzol, 20% toluol, and 8% solvent naphtha, which latter is largely xylol. The demand for toluol for explosive manufacture was always greater than the supply, but the other two constituents of light oil were produced in excess of the requirements for strictly war purposes, and other uses had to be developed.

For several years benzol and solvent naphtha, produced in the D. I. & S. plant, have been used as motor fuel by a steadily increasing number of automobile drivers in this district. Of course, benzol products were used for this purpose long before the war in France, England, and other European countries, but little was known here of the practice, and, for the general public, the fuel was new. The first users were steel company officials who obtained very gratifying results. Others soon followed and the demand has steadily increased. As was to be expected with any new thing, some individuals were dissatisfied and had all sorts of complaints against the benzol. For a time there seemed to be a tendency among the garage repair men to attribute all kinds of car trouble to the use of benzol. If a driver had run his engine short of lubricating oil or without water in the radiator and had badly overheated his engine and had at the same time been using benzol fuel, this was a demonstration that benzol gives "too hot a flame, warps the valves and burns the engine up." The benzol was a mysterious unknown factor and was a convenient goat for all kinds of trouble. In spite of such difficulties, the superior qualities of benzol motor fuel have steadily enlarged the number of more than satisfied consumers.

Criticisms of Benzol Mixtures.

Of all the criticisms made regarding the use of benzol in automobiles, only two need be considered:

First—It is said that benzol dissolves the protective coating from the cork float in the carburetor, causing it to lose its buoyancy and allow flooding. This is said to have been more frequent with Ford cars than with other makes. The usual coating material on the cork float is shellac, which is very slowly and very slightly soluble in benzol. Many drivers have used benzol for two or three years, without the slightest trouble of this kind. It is possible that various protective coatings may be used on different cars. In any case, the deterioration of the float's buoyancy seems very slow, and a simple remedy is to dry out the float and recoat with shellac. A hollow metal float may be used if desired, while a coating of celluloid varnish is also recommended. The number of cases of trouble from this source is not large. Personally, the writer is using benzol products during the third season on the same cork float without a suggestion of trouble.

Second—The statement was commonly made and at first everywhere accepted that, in using benzol it was necessary to make the mixture leaner. More air had to be taken in at the carburetor than for gasoline. After some reflection it was decided to test this point. From a theoretical standpoint it was difficult to confirm this statement. The benzol molecule is less complex than the average molecule of a gasoline mixture and requires less air for the same volume of vapor. For equal weights of benzol and gasoline also, the gasoline requires the greater quantity of air, owing to its higher percentage of hydrogen. Only in the case of equal volumes of the two liquids, would benzol, by reason of its greater specific gravity, require slightly more air for complete combustion.

Just what the action of a carburetor and engine would be, could only be determined by trial. The method employed to ascertain the degree of combustion was to sample and analyse the exhaust gas from the engine while using the different fuels. It would take too much time to give details of each test. All have pointed to the same conclusion, and only a few typical exhaust analyses will be given. These tests were made on a Model 90 Overland car with Tillotson carburetor. Samples have been taken with the engine running light and also while driving on the level and climbing hills. The nature of the exhaust gas is not affected by these varying conditions but is determined by the speed with which the engine is turning over. For low speed with a proper setting, the mixture tends to be leaner with considerable surplus air, and as the engine is speeded up, the free oxygen in the exhaust drops to one or two per cent. with the appearance of a small amount of carbon monoxide.

Results of Analytical Work.

Table I shows the effect of various settings of the carburetor needle valve, and also the effect of the surrounding temperature, both for gasoline and benzol products, all tests being made at the same engine speed, equivalent to about 17 miles per hour.

TABLE I.

Place and temperature.	Cold air inlet open.	Needle valve opened, Degs.	Analysis of Exhaust Gas. Disco Fuel 72% benzol, 21% toluol, 7% naphtha.			Gasoline.		
			CO_2	O	CO	CO_2	O	CO
Garage, 65°-70° F.	¾	290	14.9	1.7	0.6	12.8	0.8	1.4
" " "	¾	360	12.8	1.2	4.4	9.9	1.0	6.3
" " "	¾	450	8.4	1.1	11.8	6.5	1.2	11.6
" " "	¾	540	7.5	2.2	13.3	6.4	1.0	11.7
Outdoors, 25° F. ..	¾	290	10.7	6.8	nil	11.8	3.4	nil
" " " ..	¾	360	13.2	2.5	2.5	10.4	2.3	3.5
" " " ..	¾	450	9.2	2.0	9.5	7.7	2.0	8.5
" " " ..	¾	540	7.7	2.0	11.8	6.5	2.3	10.3

You will observe that the benzol gives an exhaust higher in CO_2, higher in free oxygen and lower in CO, for all ordinary carburetor settings. In the case of the needle valve being open 540°, a very much too rich setting, the carbon monoxide is higher in the benzol exhaust. This is for the same reason that a proper setting gives a higher CO_2 with benzol, namely, that the composition of benzol shows a higher ratio of carbon to hydrogen than does gasoline. Consequently, when the combustion is almost complete the CO_2 content of the exhaust will be higher for benzol, and, conversely, when the air is insufficient and

*Paper given before meeting of Maritime Chemists' Association, Sydney, N.S., July, 1919.

the fuel is burnt largely to carbon monoxide, the benzol will give a larger percentage of this gas than will gasoline.

Note the different setting required, depending on the surrounding temperature of the air.

Table II shows the effect of various adjustments of the cold-air inlet to carburetor, leaving the needle valve unaltered. These tests were made in a heated garage and at an engine speed approximately equal to 17 miles an hour.

TABLE II.

Additional test of exhaust gas from motor car engine made in heated garage, January 28th, 1919. All tests, except the last, at engine speed giving 10-ampere charge to battery. Disco fuel used.

Carburetor Adjustment.	Needle valve open.	Exhaust Gas. CO_2	O	CO
Cold-air ring ¾ open	360°	10.6	2.2	6.9
Cold-air ring closed	360°	7.2	3.8	10.6
Cold-air ring full open	360°	12.5	2.8	3.6
Cold-air ring ¾ open	290°	14.1	3.1	0.9
Cold-air ring ¾ open	360°	4.3	15.3	0.4

(Closed throttle, minimum speed on this test.)

Although the foregoing tests, and others not reported, had all indicated that no alteration of carburetor was necessary when changing from gasoline to benzol mixtures, it was decided to make a test as to whether benzol, under extreme conditions, might require a more liberal air supply than gasoline.

For this purpose the garage was heated to 110°F., or higher, by means of a gas furnace, and the cold-air inlet to carburetor was entirely closed. The air drawn in was thus taken at 110°F., and still further heated in contact with the exhaust manifold. With these conditions the needle valve was set to give a normal exhaust with gasoline. Without altering the setting, the gasoline was replaced with C. P. benzol, the most volatile member of the benzol series, and which might be expected, at the high temperature employed, to give a mixture showing a deficiency of air. Table III shows the results.

TABLE III.

In garage at 110° F. Cold air inlet to carburetor closed. Engine speed as for 17 miles per hour.

Analysis of Exhaust. Fuel C. P. Benzol. CO_2	O	CO	Fuel Gasoline. CO_2	O	CO
			11.3	2.4	2.2
14.2	2.7	1.0	10.6	1.7	4.2

Even under such extreme conditions the combustion is more nearly complete with the benzol.

Effect of Speed on Mixture.

Table IV shows the effect on the mixture of a variation in the engine speed.

TABLE IV.

Engine Conditions.	Analysis of Exhaust Gas. Fuel 60% Benzol, 40% Xylol. CO_2	O	CO	Fuel Gasoline. CO_2	O	CO	Fuel 75% Gasoline, 25% Disco Fuel. CO_2	O	CO
Engine speed approximately as for 20 miles per hour driving	13.5	2.8	1.0	11.1	2.7	2.2	—	—	—
Slow speed. Closed throttle	8.8	9.6	—	6.3	11.5	nil	—	—	—
Carburetor readjusted, but practically the same as before.									
Engine speed approximately as for 20 miles per hour driving	—	—	—	10.6	2.8	2.8	11.0	2.8	2.7
Slow speed. Closed throttle	—	—	—	—	—	—	6.8	11.1	nil

Analysis of Gas Under Driving Conditions.

Table V shows exhaust gas taken from a car under actual driving conditions, on the level and climbing a hill. The speed varied between 13 and 17 miles per hour. The exhaust shows no change in composition from that with the engine running light at the same speed.

TABLE V.

Fuel Used.	Exhaust Gas Samples. On the level. CO_2	O	CO	Climbing hill. CO_2	O	CO
Gasoline	10.4	2.1	3.8	11.4	1.4	2.8
Gasoline	9.6	2.2	4.2	Sample lost		
Disco Fuel	13.6	2.3	2.0	13.2	4.0	Lost
Disco Fuel	13.6	3.3	nil	Sample lost		
75-25 Mixture	11.1	4.9	.5	12.5	2.8	.5
75-25 Mixture	11.6	2.7	1.6	Sample lost		

The exhaust gas composition, under a great variety of conditions, surely indicates that a carburetor setting that is satisfactory for gasoline needs no adjustment when changing to benzol fuel. This conclusion is entirely confirmed by the experience of many drivers, who regularly use the same setting for both fuels with entire satisfaction and freedom from carbon trouble over a full season of long mileage.

There is one point on which no direct evidence has yet been obtained, and for which it is rather difficult to devise a satisfactory trial or experiment. It is this: Given a carburetor setting too rich for gasoline, and under which the engine is steadily accumulating a carbon deposit, would the rate of carbonizing be increased by changing to a benzol fuel? It seems quite possible that such is the case, owing to the higher percentage of carbon in benzol. If this proves to be true it would help to explain the origin of the opinion that benzol requires more air in the carburetor adjustment, The tendency with the less careful or less intelligent driver is to carry a mixture that is too rich, and which ultimately causes carbon trouble with gasoline. Possibly such a driver would have his trouble earlier by changing to benzol. This is a mere assumption, however, and remains to be tested.

Benzol shows a marked superiority over gasoline, both as regards the power developed by the engine and the mileage obtained per gallon. No definite figures have been obtained locally as to the relative power of the two fuels, but the difference is so pronounced that it needs no demonstration to one who has driven the same car on the two fuels. Hills are easily negotiated on high gear with benzol that would be difficult or impossible with gasoline.

As to the relative mileage obtained a good comparative test was made recently at the local half-mile trotting park.

The car used was a Model 90 Overland with four passengers. Total weight, 3,175 pounds. The fuel was fed into the carburetor from a graduated cylinder so that the amount consumed for each lap could be read off in cubic centimeters. The consumption was very uniform, lap after lap, showing the conditions to be remaining constant. Twenty laps were driven with gasoline and then twenty with Disco

Fuel, no alteration being made in the carburetor. The results, calculated to miles per gallon, were as follows:

Miles per gallon—Gasoline	22.98
" " Disco Fuel	30.09

31% greater mileage for the benzol.

These figures are borne out by the experience of all drivers.

There is one interesting point with regard to the behavior of benzol fuel. The spark lever can be left in the most advanced position, at all times, even when the engine is laboring at slow speed, without any sign of a knock developing. With gasoline, on the other hand, the spark must regularly be retarded with reduced engine speed, especially if under much load, to avoid a pronounced knock due to premature explosion. It would seem that the combustion of the benzol vapor was not so sudden as that of the gasoline. The difference with regard to spark control is very pronounced and cannot fail to attract the notice of a driver using benzol for the first time. It makes driving easier in eliminating any necessity of spark adjustment.

The one disadvantage of benzol products in their normal proportions as recovered from the gas, is the comparatively high freezing point.

Disco Fuel (72% benzol, 21% toluol and 7% naphtha) freezes at +10°F. Of course it is possible to blend the three in other proportions to make a perfectly satisfactory motor fuel and of as low a freezing point as desired, but this would necessitate selling one mixture in the summer and another in the winter, which would be undesirable. The best solution seems to be to blend the benzol products with enough gasoline to give a safe all-the-year round fuel. A 50-50 mixture has a freezing point of about —30°F., which would be satisfactory. Such a mixture is much superior to gasoline in power and mileage obtained. Of course, those who are able to obtain a larger proportion of toluol or xylol to depress the freezing point would not willingly accept any gasoline in their fuel if possible to avoid it.

Freezing Points of Mixtures.

Table VI gives some of the more important freezing points.

TABLE VI.

	Freezing Point.
C. P. Benzol	41° F.
C. P. Toluol	—134° F.
C. P. Xylol	— 67° F.
Mixtures.	
Benzol 95, Xylol 5	36° F.
" 90 " 10	33° F.
" 85 " 15	29° F.
" 80 " 20	23° F.
" 75 " 25	17° F.
" 70 " 30	12° F.
" 65 " 35	7° F.
" 60 " 40	1° F.
" 55 " 45	— 4° F.
" 50 " 50	—10° F.
Benzol 65, Toluol 35	— 1° F.
Benzol 60, Gasoline 40	13° F.
" 50 " 50	4° F.
" 40 " 60	— 4° F.
" 35 " 65	—10° F.
" 30 " 70	—17° F.
" 25 " 75	below —25° F.
Disco Fuel.	
71% Benzol, 22% Toluol, 7% Naphtha	10° F.
Mixtures.	
Disco 50, Gasoline 50	—29° F.
Disco 25, Gasoline 75	Probably below —50° F.

EFFECTS OF PEACE TERMS.

The *Berliner Tageblatt* summarizes the effects of the surrender of German territory as required by the peace terms as follows:

Iron.—The loss of Alsace-Lorraine carries with it the most serious effects on the German iron industry. The full significance of Lorraine is by no means brought out by a mere comparison of the steel output of the provinces (2,286,354 tons in 1913) with the total German output of 18,958,919 tons. The point of decisive importance is rather that not only the Lorraine works themselves but also the remaining West German iron establishments, especially those in Rhenish Westphalia and the Saar basin, cover their ore requirements to a very appreciable extent from the Lorraine mines. In 1913 the Lorraine and Luxemburg iron mining industry contributed to the extent of 28.5 million tons to the total German ore output of 35.9 million tons, and in respect of iron content supplied 8.15 million tons out of a total of 10.54 million, i.e., it supplied not less than 77 per cent. The loss of Lorraine would therefore make Germany dependent for the greater portion of her iron production on foreign ores, of which in 1913 she imported about 14,000,000 tons, with an iron content of 7.7 million tons. It is no doubt true that after the war it will still be possible to obtain ores from Sweden, Spain, and Russia—perhaps also even from France; but the ore basis of the German iron industry would nevertheless be so greatly restricted that a disproportion would arise between raw material and industrial product which would render the continued existence of the industry on its former scale a matter of doubt.

Zinc.—The position of the German zinc industry will also present serious difficulty. The loss of Upper Silesia involves that of the greater portion of the German ore supply, together with all the foundries which work up these ores with the assistance of Upper Silesian coal. It is sufficient to call to mind the names: Giesch's Successors, the Silesian Zinc Foundries, Ltd., and the Hohenlohe Works, to obtain an idea of what the loss of Upper Silesia would mean to this industry. The West German zinc industry, on the other hand, which is concentrated primarily in the three great works: the Rhenish-Nassau Mining and Foundry Co., the Stolberg Zinc Foundry, and the firm of Berzelius, remains practically unaffected by the cession of certain districts to Belgium. The ore mines of these works remain German. It should, however, be remembered that these firms are precisely those which in the years preceding the war were obliged to have increasing recourse to foreign ores to cover their requirements; and that in the meantime German zinc contracts, especially with Australia, have been annulled by the British and Australian courts. What has been said of the zinc industry itself applies also in the main to its by-products, which, especially sulphuric acid, are valuable basic materials for the chemical industry. They also apply in the main to the lead industry.

Potash.—It is well known that the German monopoly in potash is broken by the return of Alsace to France. A total of 14 works are thereby separated from the German potash industry. Their output of potash is about 6 per cent. of the total German output. Their real productive capacity is, however, much greater than this, and was only kept down to 6 per cent. of the German output by the system of syndication. Their production could be considerably increased, and the extent to which they, and for that matter, the Spanish works, are able to affect the foreign sales of the German potash industry has already been shown in the negotiations of the Potash Syndicate with England and America.

Determination of Iron in Battery Acid by the Ferricthiocyanate Color.

By ERNEST NYMAN*

THE acid used as electrolyte in lead storage batteries, the so-called "battery acid," is a solution of sulphuric acid in pure water. We distinguish between new electrolyte acid and electrolyte acid from batteries in service. The former is the battery acid of commerce, concentrated sulphuric acid of an approximate sp. gr. 1.835 (66°Be), specified to be a high-grade acid made from brimstone acid or by "contact process" from sulphur of suitable quality. This acid, diluted with water to a sp. gr. approximately 1.2 (the resistance being a minimum at a sp. gr. 1.224), is used for the first filling (initial charge) of the cells. According to "Standard Handbook for Electrical Engineers" (1917), the maximum allowable impurities in an electrolyte acid (sp. gr. 1.224) for first filling is as follows:

Color	Colorless
Suspended matter	Trace
Pt	Trace
Sb and As	Trace
Mn	0.0025%
Cu	0.0025%
Fe	0.005%
N, in any form	Trace
Cl	0.001%
Organic matter	None

If the battery has been in service for a long period and impurities have accumulated, a renewal of the electrolyte acid may be required. Thus for an electrolyte acid from batteries in service the maximum allowable impurities are:

Color	Colorless
Suspended matter	None other than lead compounds
Pt, As, Sb	Trace
Mn	0.005%
Cu	0.005%
Fe	0.01%
N, in any form	Trace
Cl	0.002%
Organic matter	Trace

Of the metallic impurities, those which are less electropositive than lead, particularly platinum, will be precipitated at once upon the negative plate, and the electrolyte of a cell will not show more than trace of such impurities. Iron (also manganese) being more electropositive than lead, will not be precipitated, but their presence is decidedly injurious, as they are reduced to lower states of oxidation when in contact with the negative plate, and reoxidize when in contact with the positive plate, in both cases with the formation of lead sulphate from the active materials of the plate.

The possible injuries from the presence of iron are of a much greater consequence in giving a battery its initial charge; a high degree of purity of the electrolyte acid must therefore be assured before using it in new cells. Old cells will withstand much greater quantities of impurities, wherefore often in practical work an iron content up to 0.015% is suffered (instead of 0.01%, as in the above table.

Analytical Method.

The method for estimating the iron in an electrolyte acid was worked out as follows:

Standards: (A) Stock Ferric Standard.—Dissolve 0.2004 g. of standard iron wire, 99.80% Fe), washed with ether to free it from adhering fat and dried in desiccator, in a mixture of 40 cc. concentrated H_2SO_4 (C.P.) and 80 cc. distilled water in a 400 cc. beaker with spout, keeping the beaker covered with a watch-glass. The iron dissolves in a few minutes. When all is dissolved, boil a couple of minutes, remove from heat, and add about 0.3 g. of $KClO_3$ (C.P.). Boil down to fumes, till anhydrous ferric sulphate just begins to separate out. Remove from heat, and when sufficiently cool to handle, pour the mixture into a 600 cc. beaker, containing about 150 cc. water. Rinse out the beaker with water. To dissolve salt that may still adhere to the beaker, add about 30 cc. of water to the beaker and about 10 cc. concentrated H_2SO_4, heat to a boil, and again rinse out with water. Heat the 600 cc. beaker till the ferric salt is completely dissolved and let boil a few minutes. Let cool and dilute to 1,000 cc. at standard temperature. 1 cc. = 0.0002 g. Fe.

(a) Ferric Test Standard.—Dilute 100 cc. of (A) to 1,000 cc. with distilled water. 1 cc. = 0.00002 g. Fe.

Reagents.—

Pot. chlorate, C.P. salt.

Amm. thiocyanate (C.P.) a 30% solution.

Apparatus.—

Test tube, 155 x 26 mm.

Two burettes, 10 cc., standardized against each other.

Two graduated comparison tubes, 50 cc., and graduated to one-tenth of a cc., similar as to size, volume and glass, and preferably like those, with bent ends, used for determination of carbon in steel.

A color comparison camera, similar to the one used for carbon in steel.

Manipulation.—Fill one of the burettes with electrolyte acid, the other with Ferric Test Standard. In the test tube run out 1 cc. of the new electrolyte acid (concentrated H_2SO_4) or 0.5 cc. of the electrolyte acid from batteries in service (sp. gr. about 1.2). The concentrated acid runs out slowly, owing to its high viscosity, and about 0.1 cc. adheres to the sides of the burette, when it seems to have delivered 1 cc. Therefore it is necessary to wait a minute after the first delivery to allow the amount of acid adhering to the sides to run down and make a second delivery. Over free flame, agitating, take down just to fumes. Remove from heat and immediately drop in about 0.01 g. $KClO_3$, shaking and spreading the acid in the test tube so as to decompose any $KClO_3$ adhering to the sides. Let cool somewhat, and wash down the sides with a few cc. of water. Again agitate over free flame, boiling briskly for about one minute. Cool, rinse out with a few cc. of water, three times, into one of the graduated tubes, making a total volume of 10-12 cc. Depending upon whether the acid for test is the concentrated acid or the acid of an approximate sp. gr. 1.2, add 4 cc. or 2 cc. of the thiocyanate solution (30%), and mix thoroughly by letting the liquid flow from one end of the bent tube to the other. According to the amount of iron present in the acids for test the color produced will vary, with increasing amounts

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of iron, from a faint pink color through a pinkish red to a brownish red color. Put the tube ("the Test") aside.

Prepare the "Test Standard" to match this color, as follows:

To the other graduated comparison tube add respectively 4 or 2 cc. of the thiocyanate solution and then water, so as to make the total volume a few cc. less than "the Test" volume. Add the Ferric Test Standard, drop by drop, alternately adding water so as to get the color to match "the Test" color, at the same volume, and carefully observing to wash down the sides of the tube.

Calculation:—

cc. of Ferric Test Standard x 0.002 (or 0.004) =

g. Fe in 100 cc. of concentrated electrolyte acid (or approximately sp. gr. 1.2 acid) = a.

g.% H_2SO_4 in sulphuric acid of sp. gr. 1.2 = 27.32% = b.

g.% H_2SO_4 in the electrolyte acid, through the determined sp. gr., obtained from tables = c.

sp. gr. 1.2 = d.

g.% Fe in the electrolyte acid for test, calculated to acid of sp. gr. 1.2 = E.

$$\frac{a}{c} \times \frac{b}{d} = \frac{a}{c} \times 22.7666 = E.$$

Notes on Method.

1. The Ferric Standard is prepared in approximately the same way as the electrolyte aiid for test is treated. A standard like this does not lose its Fe... value by the Fe... being reduced to Fe.., but very probably keeps it indefinitely, as judged by its absolute stability for about a year.

2. In the chemical literature on the subject it is often advocated that the test solution and the standard solution with which it is compared, must need have the same acid concentration to give the same intensity of the ferric thiocyanate color. This seems not to be necessary, because experiments proved that standards of different acid concentration gave identical colors, e.g., one standard of a sp. gr., 1.2 (27.32% H_2SO_4), the other of the sp. gr. of the Stock Ferric Standard, about 1.052 (8.36% H_2SO_4), both containing the same amount of iron, 1 cc. = 0.0002 g. Fe, gave absolutely identical colors; the color thus, at least, not being influenced within these limits. But the sulphuric acid concentration of a standard or an electrolyte acid in the moment of the comparison must be below an acid concentration of approximately sp. gr. 1.2, as was proved experimentally, because a stronger acid decomposses the ammonium thiocyanate added fairly quickly (see later), the stronger the acid the quicker naturally; and if a red color is obtained at all it fades gradually away, so that with an acid just above sp. gr. 1.2, this fading takes place somewhat during the manipulation of the test. The decomposition products of the thiocyanate and the acid are different, depending upon the concentration of the acid at a less concentration, gases as H_2S, SO_3, SO_2, HCN being given off, while concentrated H_2SO_4 acts violently, sulphur being precipitated and Carbonylsulphide, COS, given off. Again, when a few cc. of the thiocyanate solution are added to a few cc. of a Ferric Standard of the H_2SO_4 concentration (1:1), a color is obtained, but it fades away in a couple of minutes. Again, in a sulphuric acid concentration (1:3) an approximately sp. gr. 1.289 (37.95%H_2SO_4), the color fades away totally in a couple of hours. When to this solution were added a few cc. of the thiocyanate solution, no red color was developed, showing that all the Fe... was reduced to the Fe.. state, but when some $KClO_3$ was added the color was developed, but it faded away, in about ten minutes' time a white ppt. separated, and an odor of H_2S and HCN was noticed. This white ppte. on standing appeared to change into canary yellow, neddle-shaped crystals, probably perthiocyanic acid $(HCN)_2S_3$.

Also in an acid concentration of that of 1 cc. of the Ferric Test Standard (8.36% H_2SO_4) to which 12 cc. of distilled water and 2 cc. of the thiocyanate solution were added, thus giving a sulphuric acid concentration of an approximately sp. gr. 1.004 (0.6% H_2SO_4), a total fading away of the color was noticed to take place in about three days, a slow decomposition thus going on also in such a weak acid concentration.

3. The reason for taking the electrolyte acid down to fumes and of adding $KClO_3$ is to thoroughly destroy organic matter (originally present in the acid or by later contamination) and to effect the highest oxidation of other metals that may be present as well as the iron, which in an electrolyte acid, especially the concentrated one, is not wholly in the Fe... state, certain amounts of Fe.. always being present. The $KClO_3$ acted on by fuming concentrated H_2SO_4 forms first, very probably, Cl_2O_5: $2KClO_3 + H_2SO_4 = K_2SO_4 + H_2O + Cl_2O_5$. The Cl_2O_5 decomposes immediately to Cl_2 and O_2, this accomplishing a powerful external oxidation, while a relatively insignificant part only of the Cl_2 is oxidized to $HClO_4$. After the oxidation and dilution the solution is boiled briskly to drive off the excess of Cl_2 and O_2 and volatile oxidation products.

4. Care must be taken to add exactly the same amount of the thiocyanate solution to "Test" and "Test Standard," because the intensity of the color produced changes quite sensibly with the amount of the thiocyanate solution added.

Relatively small quantities of iron, say about 0.001% Fe, need a larger amount of the thiocyanate solution than larger amounts, say about 0.01 Fe; otherwise a too weak or a yellowish coloration will result; relatively large amounts of iron, say about 0.03% Fe, need also a larger amount, because the deeper color produced must be more diluted to be suitable for comparison; and when the amount of the thiocyanate solution added is not sufficiently increased with the increased dilution no pink color results, but a yellowish coloration. To be able always to obtain a pure pink color up to a maximum dilution of 50 cc., at which color the writer prefers to do the comparison, an addition of a quantity of thiocyanate, contained in 2 cc. of a 30% solution, has proven satisfactory, when 0.5 cc. of the electrolyte acid from batteries in service is taken for the test. Again 1 cc. of the new electrolyte acid is taken for the test and 4 cc. of the thiocyanate solution is added; also when the color of this concentrated acid is compared the volume of the solution is to be kept as low as possible, so that the intensity of the color developed may be strong enough, as a very faint pink color is produced in acids, containing, say, 0.001% Fe (on acid sp. gr. 1.2). To be able, if it be so desired, to absolutely accurately determine an iron amount of this magnitude, it is better to use more than 4 cc. of the thiocyanate solu-

tion to intensify the color. But as the specifications permit a minimum amount of 0.005%, the method has been worked out on that basis.

5. Copper is an element that might be present in an amount that would interfere with the color intensity., e.g., an amount of 0.1% Cu as $CuSO_4$, added to an electrolyte acid, containing 0.01% iron, which acid then was tested according to the method, gave a yellowish color, making a determination of the Fe impossible. But when only 0.01% of Cu was added, a reddish pink color was obtained, although so much weaker, that instead of 0.01% Fe as obtained, when no Cu was present, the result was 0.008% Fe. A quantity of about 0.01% Cu thus seems to lower the iron result 0.002%. However, such an amount of copper is hardly likely to occur in the electrolyte acids usually supplied for batteries. But if Cu is present it may be identified and removed by sodium thiosulphate, e.g., when 1 cc. of a concentrated electrolyte acid was diluted with a few cc. distilled water and as little as 0.00001 g. Cu as $CuSO_4$ (thus about 0.000002 g. Cu calculated on an acid of approximate sp. gr. 1.2) was added, and to this solution 1 cc. of a n/10 $Na_2S_2O_35H_2O$ solution, and the solution heated to boiling, a decided darkening of the solution was observed, and, on standing, a minute black precipitate of Cu_2S separated out. The identification of copper by $Na_2S_2O_3$ is thus fairly sharp, an amount of about one-tenth of the amount allowed according to the specifications (0.0025% Cu) being clearly identified.

To remove the copper, before testing for iron, the following procedure was used:

To 1 cc. of electrolyte acid in a test tube, 4-5 cc. of water were added, then 1 cc. of a N/10 $Na_2S_2O_3$ solution; the solution boiled a minute, filtered in a 100 cc. Erlenmeyer flask, the filtrate taken down to fumes, 0.01 g. $KClO_3$ added, etc., as the regular method calls for.

6. The concentrated electrolyte acid may contain lead sulphate in solution. This will precipitate out when water is added. This somewhat obscures the color, but when standing a while the lead sulphate will settle and a clear color is obtained. If larger amounts are present it is better to dilute the 1 cc. of the acid taken for test with a couple of cc. of water, centrifuge the mixture, and pour off from the settled lead sulphate the acid, which is then tested for iron according to the method outlined above.

Conclusion.

By this color method it is possible to test an electrolyte acid for iron in less than five minutes. As to speed, the method thus compares very favorably to the gravimetric as well as the volumetric permanganate method; the same is the case as to accuracy, because, besides being exceedingly sensitive for mineral changes in the amount of iron it also being very simple, can be manipulated accurately by an inexperienced man. On the other hand, the gravimetric method, and particularly the volumetric method, when traces of iron are in question, are reliable only in the hands of an experienced chemist. The method, also, very probably can be applied to determination of iron, particularly traces of iron in other kinds of matter, either directly, when interfering substances are not present, or by isolating the iron at first, followed by its solution in sulphuric acid.

Winnipeg, Man., June 13, 1919.

REPORTS AND CATALOGUES REVIEWED.

Electro-Platers' Equipment and Supplies. Catalogue No. 9.

The Canadian Hanson and Van Winkle Company, Limited, Toronto, Ont. An illustrated catalogue of 260 pages, well arranged, with each article fully described in good, clear English. Some of the products of the company's factory displayed are: Compound-wound dynamos, "inter-pole" generators, batteries, rheostats, respirators, electro-plating outfits, emery wheels, chemical stoneware and glassware, tanks and cleaning compounds.

Report of Minister of Mines of British Columbia for Year ending December 31, 1918.

In this B. C. Government report William R. Robertson, provincial mineralogist, makes his annual report on the mining industry of British Columbia during 1918. The total mineral production in British Columbia in 1918 was $41,782,474, while since the year 1852 to 1918 (inclusive) the total mineral production of the province was $637,353,581. The report has 510 pages, with some illustrations and several good maps.

Notes on the Lead Mines of Southwest Missouri. By F. G. Hyder.

A twelve-page report of the Department of the Interior of the U. S. Government, giving much valuable information concerning these deposits, with a review of the different companies operating them.

COBALT SILVER.

"Never before has the outlook of the mining industry of Northern Ontario looked so promising as it does to-day," states *The Northern Miner* of Cobalt. "Men are now more plentiful than in years . . . supplies and machinery are coming down in price . . . silver is at the highest price in the history of our silver mining, and while Cobalt (the district) has already had longer life than was generally prophesied by mining men, the present conditions for the market of silver have added years to the probable life of Cobalt. And our gold mines promise to eclipse the wonderful record of silver mining. Porcupine has no apparent rival as the leading gold camp in Northern Ontario. Ore reserves of the operating gold mines are now in the neighborhood of sixty million dollars."

CHINA PRODUCING CEMENT.

The cement requirements of North China will probably soon be supplied by domestic production. One large concern is said to control this industry in North China, and its plant is located at Tangshan, a small town about 100 miles north-east of Tientsin, on the Peking-Mukden Railway. It is equipped with modern machinery and secures its supplies of limestone on the site of the works.

JAPAN AND WATER POWER.

Japan has set aside the equivalent of $400,000 for the investigation of sites for hydro-electric power plants. The program of the government includes the selection of 635 power sites, and only those sites where more than 1,000 measures 607,500 square kilometers, or larger than any surveyed at present.

The "Alkali" Content of Soils as Related to Crop Growth*

By FRANK T. SHUTT and E. A. SMITH

Introduction.

THE nature, concentration and distribution of "alkali" as occurring in soils of certain semi-arid districts of Western Canada, have been studied during the past five years in the laboratories of the Experimental Farm Ottawa. The work has included the analysis of several hundreds of soil groups collected chiefly in tracts about to be placed under irrigation in Southern Alberta. The data so obtained have materially assisted the Government in the classification of the areas in question into irrigable and non-irrigable lands. For the purpose of applying these data, American standards as regards safe limits of alkali have largely been used. The results presented in this paper are a contribution towards the establishment of standards more particularly adapted to Canadian conditions.

The Nature and Formation of Soils in General.

Arable soils are made up of two great classes of constituents: (1) Mineral, as derived from the disintegration and partial decomposition of rock material; and (2) vegetable matter, the semi-decomposed remains of past generations of plant life, commonly known as humus. It is from the former that the stores of lime, phosphoric acid, potash, etc., present in the soil are furnished, while the latter supplies the nitrogen required for crop growth and at the same time acts as an important factor in supporting bacterial life and in regulating the temperature, the moisture-content and the aeration of the soil.

Soil formation is not merely a matter of the past, it is now going on. Under natural conditions, as in the forests, our soils are being constantly enriched in humus from decaying roots, fallen leaves—from the death and decay of vegetation generally, and, further, by physical changes and chemical reactions, favored by warmth, moisture, carbonic acid of the atmosphere, etc., the rock elements of the soil are being continually, though slowly, disintegrated and decomposed, giving rise to soluble mineral compounds, some of which may be useful and others injurious to plant life.

The Formation of Alkali.

In humid districts, i.e., those enjoying a more or less generous rainfall, the mineral salts formed by these processes, known popularly as "weathering," are practically disposed of as produced. In part, they are utilized by vegetation, and any remaining injurious salts leach downwards and drain away; the conditions are such that there can be no accumulation of them in the surface soil.

But such is not always or necessarily the case in arid or semi-arid districts. Here we find the scanty rainfall, while sufficient to promote the formation of these soluble mineral salts, quite inadequate to their removal by drainage. If they descend a few inches, or even a few feet, there is not enough flow of water through the soil to carry them right away and subsequent evaporation of the water that holds them in solution and the action of capillarity brings them to the surface, where they accumulate, forming the so-called alkali and rendering the soil more or less unsuitable for agricultural purposes. The alkali may impregnate the sub-soil, the surface soil, or, if evaporation greatly exceeds the rainfall, it may appear as an incrustation or efflorescence.

Alkali soils, therefore, are characteristic of arid or semi-arid districts only and these in Canada may be said to be restricted chiefly to certain areas in British Columbia, Southern Alberta and Southwestern Saskatchewan.

Nature of "Alkali."

The compounds known collectively as alkali comprise chiefly sodium sulphate, sodium carbonate, sodium chloride, magnesium sulphate, calcium sulphate (gypsum) when present in large quantities, and occasionally chlorides of calcium and magnesium. Sulphate and chloride of sodium and sulphate of magnesium and of calcium, when crystallized on the surface of the soil, appear as white substances and constitute what is known as "white alkali." "Black alkali" is characterized by the presence of sodium carbonate, though this compound is almost always associated with one or more of the sulphates mentioned above. Sodium carbonate is, as is well known, white, but from the fact that it acts upon and dissolves the decayed vegetable matter (humus) of the soil the incrustation is dark brown or black. Hence the name. Water standing in pools on soils impregnated with sodium carbonate is invariably of a dark color resembling a strong infusion of coffee.

Effects of Alkali on Plants.

The soil water of lands impregnated with alkali is a more or less concentrated solution of these compounds. It is the soil moisture which assists in the germination of the seed and is the means of conveying food to the plant rootlets; for the performance of these important functions it is obvious that it should possess no injurious properties. The effect of a solution such as we find in alkali soils on the cells in the tissues of the roots is to extract or withdraw from them by osmosis their natural water. As a result, the cells lose their turgidity, their protoplasmic contents shrink from the cell wall, the plant wilts and death may ensue. The higher the percentage of alkali—in other words, the more concentrated the solution—the more severe the effect in this direction. Chlorides are more injurious than sulphates.

"Black" alkali is much more injurious than "white" alkali. The sodium carbonate it contains is directly corrosive, causing injury at the base of the trunk or root crown of the plant, by cutting into and eating away the tissues. The bark of green herbaceous stems is usually turned to a brownish tinge for half an inch or more immediately above the surface of the ground, becoming soft and easily peeling off. The rough bark of trees is found to be almost black and the green layer underneath, brown. Very small quantities are sufficient to prevent seed germination, or to destroy the tender rootlets of the seedling, if the young plant appears.

All kinds of alkali have a tendency to destroy a soil's tilth, but this is particularly marked in the case of black alkali. The soil readily puddles, flocculation, or the property of forming flakes, is destroyed and the land becomes in a large degree impervious to water. On drying, hard refractory masses are formed and the soil is extremely difficult to work. Very frequently a hard, practically an impenetrable, hard-pan forms under such soils, making it almost impossible to put in a system of tile sub-drainage.

Crops differ greatly in their susceptibility to alkali; some are so resistant that they may thrive and come to maturity

on soils that for the majority of farm crops there can be no possible hope of success. Apart, however, from this question of relative resistancy of crops, the composition, concentration and vertical distribution of the alkali and the physical character of the soil are all important matters in reaching a conclusion as to the desirability and safety of placing an affected area under irrigation. Injudicious or excessive application of irrigation water to soil impregnated with alkali, especially if the subsoil is of an impervious character and sub-drainage is not provided, may ruin, by bringing up the alkali, what would otherwise be excellent land for cultivation under dry-farming methods. The irrigation of impregnated land without efficient drainage—natural or artificial—almost invariably gives rise to "rise of alkali," and this, in the past, has been a fruitful cause of the ruination in the Western States of large areas of once cultivable, fertile soil.

Limits of Toxicity.

The present paper records the results of the analysis of five series of soil groups, each series consisting of three groups representative of land upon which (1) there was fair or good growth, the concentration of alkali, if present, being apparently and for practical purposes negligible; (2) there was poor growth, the crop evidently being distressed by alkali, and (3) there was no growth due to excess of alkali. Each series represents a separate tract of land (or field), the three groups being frequently collected within a short distance of one another. As in all our work in connection with the irrigation tracts, each group consisted of five samples: A—0′.0-0′.5, B—0′.5-1′.5, C—1′.5-3′.0, and D—3′.0-5′.0.

Western Rye Grass.

Series I.—Sec. 20, Tp. 9, R. 27, W. of the 3rd Meridian. Field of Western rye grass about 18 miles south-west of Maple Creek, Sask. The land had been under irrigation for six years, during which time the bare alkali spots or patches had increased in size very considerably. Had been sown to wheat, 1910; oats, 1911, and seeded to western rye grass. Crop at time of visit, July 4th, 1917, was only fair on better parts of field, the plants being 4 to 6 inches in height. Soil a dark brown (almost black) moderately light loam, of good quality; sub-soil of heavier character, a dark grey to yellow grey clay with a little sand. Water table, from 3 to 5 feet, according to contour of land. One group of samples taken from a bare spot, the second in sparse and meagre growth, about 15 feet distant, and the third in the best growth, about 80 feet from the same point of collection.

Western Rye Grass.

Series I.—Sec. 20, Tp. 9, R. 27, W. of the 3rd Meridian.

Group No.	Depth.	Growth.	Na_2So_4	$MgSo_4$	$CaSo_4$	Total soluble saline
1603	0′.0-0′.5	Fair	.089	...	...	.128
	0′.5-1′.5	to	.073	...	...	.120
	1′.5-3′.0	good	.085	...	...	.168
	3′.0-5′.0		.641	.504	1.307	2.436
1602	0′.0-0′.5	Poor	.117	...	...	.152
	0′.5-1′.5		.254	...	...	.300
	1′.5-3′.0		.618	...	...	.700
	3′.0-5′.0		.980	.580	1.376	3.016
1601	0′.0-0′.5	No.	1.109	.279	.233	1.748
	0′.5-1′.5		1.033	.309	.272	1,656
	1′.5-3′.0		.964	.066	.104	1.200
	3′.0-5′.0		1.189	.210	.304	1.756

Discussion of Results.—The impregnation is white alkali, the chief constituent being sodium sulphate. Magnesium sulphate is present in certain of the members, but chlorides are absent, save in traces, throughout the series. In samples D (3′.0-5′.0) of two of the groups calcium sulphate is present in considerable amounts. This compound cannot properly be classed as alkali, though it is somewhat open to question if it is altogether inert towards growing vegetation when present in amounts approaching 1 per cent.

Group 1603—Fair to good growth. The sodium sulphate content is very low and practically uniform to a depth of 3′.0, the amount in A, B and C being less than .1 per cent., which is usually regarded as negligible.*

In D (3′.0-5″.0) there is a serious increase of this salt to .641 per cent., accompanied by .504 per cent. magnesium sulphate. It is doubtful if, at this depth, this alkali markedly affects the grass crop. The danger of its presence lies in the possibility of its rise by irrigation.

Group 1602—Meagre and distressed growth. The percentages of sodium sulphate are considerably higher than in the corresponding members of the preceding group, ranging from .117 per cent. to .980 per cent., the increase being steady and marked from A (0′.0 to 0′.5) to D (3′.0-5′.0).

Judging from the sparse and meagre appearance of the crop, we might conclude that in this group we closely approach, for western rye grass, the limits for tolerance.

Group 1601—No growth; soil bare. The percentages of sodium sulphate throughout closely approximate 1.0, the concentration being fairly uniform from the surface to the depth of 5 feet. Notable amounts of magnesium sulphate are present in all the members of this group, save C (1′.5-3′.0).

The alkali impregnation of this group far exceeds the extreme limit of tolerance for ordinary farm crops.

Native Prairie Grass.

Series II.—Sec. 9, Tp. 11, R. 25 W. of 3rd Meridian.

From irrigated field 7 miles south-east of Maple Creek, Sask. The land had been under irrigation for a number of years but had never been cultivated, the native grass being cut and cured as hay. The surface soil was a fairly good sandy loam, the subsoil of heavier nature, containing a considerable proportion of clay. In the best parts of the field the grass was of good growth. Samples collected July 6th, 1917.

Native Prairie Grass.

Series II.—Sec. 9, Tp. 11, R. 25 W. of 3rd Meridian.

Group No.	Depth.	Growth.	Na_2So_4	$MgSo_4$	$CaSo_4$	Total soluble saline content.
1606	0′.0-0′.5	Good	.070	...	...	.136
	0′.5-1′.5		.641	.104	.128	.916
	1′.5-3′.0		.731	.109	.109	.960
	3′.0-5′.0		.541	.185	.136	.864
1605	0′.0-0′.5	Poor	.432	...	.110	.584
	0′.5-1′.5		1.001	.272	.136	1.428
	1′.5-3′.0		.765	...	.066	.920
	3′.0-5′.0		1.662	...	.825	2.696
1604	0′.0-0′.5	No.	2.407	.578	...	3.108
	0′.5-1′.5		2.175	.501	.216	2.768
	1′.5-2′.8		2.454	.378	.527	3.360

Discussion of Results.—In this, as in Series I., the alkali is chiefly sodium sulphate, but magnesium sulphate is also

*Less than .2 per cent. sodium sulphate, unless concentrated in the first foot, is regarded by most American authorities as not injuriously affecting ordinary farm crops.

present in notable amounts, especially in Group 1604, characterized by "no growth."

Group 1606. Good growth. The sodium sulphate in A (0'.0-0'.5) is present in negligible amounts but in the lower members of this group it reaches percentages ranging from .541 (in D) to .731 (in C), accompanied by small amounts of magnesium sulphate.

It might be inferred from these facts that, provided the alkali in the first 6 inches of soil were negligible and that it did not exceed .7 per cent. from 1'.5-5'.0, that native prairie grass might be expected to make a good growth, without any marked distress.

Group 1605. Poor and meagre growth. The concentration of sodium sulphate in A (0'.0-0'.5) is .432 per cent., but increases markedly in the lower members of that group, amounting to 1.662 per cent. in D.

This distribution of alkali probably represents the limits of tolerance for native prairie grass under irrigation. An amount approaching .5 per cent. in the first 6 inches, underlaid by soil containing 1 per cent. or more of alkali, would seem to be the extreme condition under which the native grass might be expected to yield a crop. It is interesting to note, comparing the two series discussed, that the native prairie grasses are more alkali-resistant than western rye grass.

Group 1604. No growth. Soil bare. The percentage of sodium sulphate throughout this group exceeds 2.0 per cent., an impregnation too high to permit of any growth.

(NOTE.—The samples in this group represent a depth only of 2'.8, collection below that depth being made impossible by the caving in of the sides of the sampling bore.)

Oats.

Series III.—Sec. 17, T. 24, R. 24, W. of the 4th Meridian.

These three soil groups were collected on July 17th, 1917, from a field in oats on Farm No. 8, Namaka Colony, about 4½ miles north-east of Strathmore, Alberta. The area had been under irrigation for some years but water had not been applied in 1917. The soil was a sandy loam of good quality. The yield of oats on the best parts of the field would be probably 75 bushels per acre; in the portions showing distressed growth the yield would probably be scarcely worth the harvesting.

Oats.

Series III.—Sec. 17, T. 24, R. 24, W. of the 4th Meridian.

Group No.	Depth.	Growth.	Na_2Co_3	$NaSo_4$	$MgSo_4$	Total soluble saline content.
1620	0'.0-0'.5	Good	.061	...	...	.128
	0'.5-1'.5		.065	...	...	.112
	1'.5-3'.0		.065	...	...	.136
	3'.5-5'.0		.060	...	...	.132
1619	0'.0-0'.5	Poor	.212	.108	.087	.480
	0'.5-1'.5		.149	...	.138	.276
	1'.5-3'.0		.128	...	.096	.232
	3'.5-5'.0		.077	...	.066	.164
1618	0'.0-0'.5	No.	.340	.343	.087	.842
	0'.5-1'.5		.292	...	.087	.448
	1'.5-3'.0		.210	...	.090	.312
	3'.5-5'.0		.128	...	.077	.252

Discussion of Results.—The alkali of this group is sodium carbonate, the characteristic salt of "black alkali" and which, as already stated, is the most injurious of all saline impregnations. The limits of tolerance for most farm crops are usually placed by American authorities between .05 and .1 per cent.

The soil of group 1620 carried a good crop of oats and contained uniformly to a depth of 5 feet .06 per cent. of sodium carbonate, in addition to trifling amounts of other and less injurious saline matter. These results must not be interpreted as proving that this concentration of sodium carbonate is harmless, but they are of peculiar significance in showing that this impregnation does not appreciably distress the oat crop on a light, sandy soil well supplied with humus.

In group 1619 the concentration of alkali is highest in the surface soil (A .212 per cent.), decreasing steadily in the lower samples (D .077 per cent.). The growth was very sparse and poor and it was evident that the limit of tolerance had been passed.

The samples of group 1618, taken from a location in the same field and absolutely bare of vegetation, show a very heavy impregnation of sodium carbonate, the highest concentration, .340 per cent., being found in the surface soil A and decreasing with depth of sampling to .28 per cent. in D.

A feature worthy of note in connection with these two latter groups is that the alkali is strongest in the surface soil, decreasing steadily, and more or less uniformly, to the depth of sampling, 5 feet.

Wheat.

Series IV.—Sec. 3, Tp. 5, R. 22, W. of the 4th Meridian.

The samples of this series were collected in a wheat field three miles north of Magrath, Alberta. The area was not under irrigation. The yield for the field at the date of this visit (August 8th, 1917) was estimated at 15 bushels per acre; in 1916 the yield of wheat was stated at 55 bushels per acre. The surface soil was a brown loam of fairly good quality, the subsoil a rather heavy clay.

Wheat.

Series IV.—Sec. 22, Tp. 5, R. 22, W. of the 4th Meridian.

Group No.	Depth.	Growth.	Na_2So_4	$MgSo_4$	$CaSo_4$	Total soluble saline content.
1634	0'.0-0'.5	Good	...	...	...	...
	0'.5-1'.5		.178	.087	.163	.440
	1'.5-3'.0		.877	.132	.447	1.572
	3'.0-5'.0		.973	.563	2.926	4.640
1633	0'.0-0'.5	Poor	.123	...	...	.180
	0'.5-1'.5		.701	.247	.491	1.480
	1'.5-3'.0		.719	.309	.588	1.680
	3'.0-5'.0		.799	.062	.192	1.060
1632	0'.0-0'.5	No.	1.741	.900	.648	3.260
	0'.5-1'.5		1.001	.323	.364	1.700
	1'.5-3'.0		.701	.222	.220	1.164
	3'.0-5'.0		.579	.084	192	.900

Discussion of Results.—This is a case of white alkali, the percentages of sodium sulphate being accompanied with notable amounts of magnesium sulphate.

In group 1634—good growth—"A," representing the first 6 inches, is free, or practically free, of alkali. "B" (0'.5-1'.5) contains a notable, though not heavy, impregnation, the percentage of sodium sulphate slightly exceeding, according

to most authorities, the usual limit of tolerance for the vigorous growth of ordinary crops. In "C" and "D" the alkali content is very large.

Group 1633, representative of the area carrying a meagre and poor growth, is of particular interest in indicating probably the limit of tolerance for wheat. In the first 6 inches sodium sulphate is present in an amount that would no doubt cause some distresss, but would not inhibit all growth. But in B, C and D there is a very marked increase in this salt, accompanied by magnesium sulphate, the totals being such as to entirely prevent root extension. The crop is, therefore, limited as to its foraging ground to the immediate surface soil.

Group 1632 contains in A (0'.0-0'.5) 1.741 per cent. sodium sulphate and .900 per cent. magnesium sulphate. This concentration of alkali is absolutely inhibitive for wheat and, indeed, renders the soil worthless for common crops. The salts gradually decrease in amount to the 5-foot depth, but in every instance the impregnation greatly exceeds the limit of tolerance.

Onions.

Series V.—Lot 27-476, Summerland, B.C.

This series was taken from an onion field about four miles southwest of Summerland, Okanagan Valley, B.C. The area has been under irrigation for a number of years. The surface soil is a dark-brown, sandy loam, well supplied with vegetable matter, the subsoil a sand mixed with silty clay. Samples were collected August 25th, 1917.

Onions.

Series V.—Lot 27-476, Summerland, B.C.

Group No.	Depth.	Growth.	No_2Co_3	Total saline content. soluble
1628	0'.0-0'.5	Good	.135	.180
	0'.5-1'.5		.120	.160
	1'.5-3'.0		.072	.108
	3'.0-5'.0		.053	.108
1627	0'.0-0'.5	Poor	.224	.330
	0'.5-1'.5		1.120	.138
	1'.5-3'.0		.087	.096
	3'.0-5'.0		.094	.098
1626	0'.0.-0'.5	No.	.529	.640
	0'.5-1'.5		.424	.440
	1'.5-3'.0		.135	.172
	3'.0-5'.0		.085	.120

The impregnation of this series is sodium carbonate, black alkali, other salts being present in traces only.

In group 1628, the best growth, the concentration of alkali in the first 6 inches amounts to .135 per cent., which somewhat exceeds the usually accepted limit of tolerance for farm crops in general. It would seem, therefore, that onions might be classed with those crops which are more or less alkali resistant.

The concentration, as in the other groups of the series, diminishes with depth of sampling, evidently a characteristic of areas impregnated with black alkali.

Group 1627, representing the poor and distressed growth, probably marks the extreme limit of toxicity which this crop can bear. The amount in "A" (.224 per cent.) is much higher than crops in general could endure. In its lower members the alkali content corresponds very closely to that of group 1628, showing that it is the concentration in the immediate surface soil that is the crucial factor in determining growth.

The percentages of sodium carbonate of group 1626 are not much higher than 1627, yet they are sufficient to inhibit all growth. In this series we have an illustration of the fact that in the case of black alkali slight differences in the concentration are of very considerable significance. With "white alkali" the differences which mark the limit of toxicity are of much greater magnitude.

It is proposed to continue these studies for a number of seasons, obtaining further evidence as to the limits of tolerance for various farm crops and at the same time ascertaining to what extent and in what manner the distribution of alkali is affected by irrigation with and without drainage. The work here recorded is to be regarded as merely the first step towards the establishment of standards for Canadian conditions.

*Read before Section III. (Chemistry and Physics) of Royal Society of Canada.

CANADA'S SOIL RESOURCES.

The total annual value of the field crops of Canada is about $900,000,000, and of live stock about $950,000,000. If this total of $1,850,000,000 could be doubled in three or five years by fertilization and improved methods, what a transformation it would make in the development of the country. But even this is not the measure of the possibilities: the present total cultivated area of Canada is 39,000,000 acres, but the grand total of our land area is over 2,300,000,000 acres, and if a billion acres of this were taken off as non-accessible, it would still leave for the application of modern methods on new lands a prospect such as this generation can hardly imagine.

CONSTITUENTS OF PLANT FOOD.

Necessary.

Carbon (from Co_2 of air) constitutes 45 to 50 per cent. of plant dry matter.

Water (from the soil) constitutes from 80 to 95 per cent. of the growing plant. Water is the carrier of plantfood. **All food which enters the plant must be soluble.** A shortage of water, therefore, starves the crop.

Calcium gives strength to the cells of the plant.

Nitrogen increases foliage and top growth of the plant.

Phosphoric Acid hastens the maturity of the plant and greatly aids root formation.

Potash gives strength to the plant and aids in the formation of starch in the kernel or fruit.

Magnesium influences the taking up of phosphoric acid from the soil, and in the plumping of the kernel.

Sulphur assists in the formation of protein.

Iron takes part in the maintenance of green matter or chlorophyll in the stalks or leaves.

Unnecessary.

Four additional materials are frequently found in the plant—sodium, chlorine, manganese and silicon. These are taken up in combination with some of the above plantfoods in small quantities.

NOTE.—The above plantfoods are normally present in soils in sufficient quantity for best crops, *excepting nitrogen, prosphoric acid and potash, which must be supplied in manure and fertilizers.*

Fish Waste Fertilizer Plant at Port Stanley.

FISH WASTE AS A FERTILIZER.

The use of fish waste as a land manure has been an old industry in Europe and the British Isles, and around the fishing stations of the Maritime Provinces of Canada spoiled fish have been used for this purpose for generations, but the first plant in Canada to use modern machinery for reducing fish offal to fertilizer is that of the Port Stanley

Port Stanley Supply Co's. Plant.

Supply Co., at Port Stanley, on Lake Erie. The successful operation of this plant since 1914, and the construction of the new plant in Nova Scotia referred to elsewhere, give promise of an important industry which will help to restore worn out soils and recover valuable materials hitherto wasted.

For an outline of the operations at Port Stanley, we are indebted to a report in the "Canadian Fisherman," from which it appears that the plant of the Port Stanley Supply Co., cost $10,000 and has a capacity of 16 tons per day, the fertilizer being largely disposed of in the adjoining farming districts while the by-product in fish oil is shipped to the cities. The output in oil in 1917 was 12,000 gals., and since then a new product is being put on the market in the form of fish meal for stock food.

For fish meal the non-edible fish and fish offal are taken from the boat onto the dock, near the plant, and from there dumped into a receiving hopper located directly under the building. From there it is drawn through a 6 in. iron pipe by a vacuum pump into the evaporator. This makes a sanitary method for conveying the raw material from the storage hopper into the evaporator. The evaporator holds 4½ tons of raw material per charge. For evaporating the moisture, the heat is applied by jackets on the sides and bottom, and all the gases coming from the material during cooking are drawn out under vacuum and through a jet condenser, the condensable gases being condensed and the non-condensable gases conveyed underneath the boiler grates and consumed.

As the raw material contains about 65 to 70% of moisture, a sufficient amount of moisture is already there to assure a thorough cook. By the time the moisture is evaporated down to 15 to 18%, the fibrous matter has been thoroughly cooked, and all the oil liberated from the oil cellicules, leaving it free from strong odors usually coming from fish oils. This is due to the moistures and gases being drawn out under vacuum. The fish meal having also been dried under vacuum is of a very high percentage of protein, due to the moisture being drawn out under low temperature. This assures the retaining of all the nitrogen on which the value of fish meal is based, likewise all of the ingredients contained in the finished meal as no direct steam cooking is done whereby any of the glutenous matter would become diluted and drawn off in the usual stock water manner.

After the material has been evaporated, which usually takes about 4½ hours, it is taken from the evaporator and placed on an inclined floor and allowed to cool about 12 hours. The floor being inclined to trap such oils as might run off freely, the material is placed in a hydraulic press and the oils pressed out, until there is about 14 to 16% of oil left in the fish meal. This is a very suitable percentage for feeding purposes.

After the meal has been taken from the press, it is run through a mill and reduced to powder. The value of this stock food has been recognized and it has in the last three or four years been largely used in the United States as well as Europe.

The Managing Director of the Company is Mr. W. H. McPherson, who sees a great future for the industry.

MAY MAKE POTATO FLOUR.

The establishment of an industry for the manufacture of potato flour in New Brunswick is looked upon as a promising development that may be entered upon in that province.

MEXICAN OIL RESOURCES.

The well-known expert, Jose Querait Mir, has issued a report stating that the area of the oil zones in Mexico measure 607,500 square kilometres, or larger than the whole of France. At present only about 8,000 square kilometers are being developed.

SIR WILLIAM CROOKES.

The year 1919 has seen the passing away of several eminent men of science, and none, perhaps, did more to advance true science than Sir William Crookes, who passed away at London, England, on April 4th last.

Sir William was born in London, June 17, 1832, and had therefore reached the advanced age of 87 years when death terminated his valuable and active career. All through the period of the war he had been called on repeatedly to serve on important National Committees along scientific and research lines, and right up to within a few days of his death was taking an active interest in all these problems.

Sir William received his education at the Royal College of Chemistry, becoming an assistant professor there in 1851.

In 1861 he discovered thallium, a new element, while conducting an examination of the residue left in the manufacture of sulphuric acid, and while carrying out investigations of the metal and its properties found that it appeared heavier when cold than when hot. This was explained by him as being due to a repulsion by radiation. Utilizing the principle he had thus discovered, he constructed the radio meter, which in turn led him to his famous researches on the phenomena produced by the discharge of electricity through tubes from which the air had been exhausted. To the development of this work the scientific world owes its present "electronic" theory, involving "radiant matter."

Later he began an inquiry into the constitutions of rare earths, his researches leading him to results which proved startling to scientists. On the discovery of radium he took up the study of the element, doing much to bring its forces to the service of mankind. He wrote and edited various works on chemistry and chemical technology, and in his later years gave considerable attention to psychic phenomena, which he endeavored to correlate with physical laws.

He was editor and proprietor of "Chemical News," a weekly scientific journal, which has a very high rating among all chemists and physicists.

In 1898, he startled the world by his warning of an approaching scarcity in the supply of wheat and of the necessity for a solution of the nitrogen problem, so that an abundant supply of nitrogenous fertilizers might be obtained, thus advancing the danger line of food supply many generations in the future.

In 1904, he was Knighted and was the recipient of many honors from scientific societies in Europe. In 1856, he married Ellen, daughter of W. Humphrey, of Darlington. She died in 1916. He is survived by four sons and one daughter.

SHAWINIGAN LABORATORIES, LIMITED.

The Shawinigan Water and Power Company have announced the reorganization of a new subsidiary, called the Shawinigan Laboratories, Limited, whose prime function is to carry on the development and experimental work for the Shawinigan Water and Power Company and its subsidiaries, together with any investigation work required by Aldred & Company, New York and Montreal.

This company was formed some three years ago to carry on the development work for the manufacture of acetic acid, acetone and acetaldehyde from carbide. On the organization of the Canadian Electro Products Company, to construct and operate a plant for the production of these products at Shawinigan Falls, the personnel of this organization was incorporated into the Canadian Electro Products Company as their Research Department. The technical men composing this organization carried out all experimental and development work on this intricate process, and have, since being incorporated in the Canadian Electro Products Company, been devoted primarily to improvements to the process.

In the last few years the industries of the Shawinigan Company have developed to such an extent that it was found advisable by the Board of Directors that all experimental and development work should be centralized in one organization. Some of the more important industrial subsidiaries are: Canada Carbide Company, Limited; Shawinigan Electro Metals Company; Canadian Electro Products Company, Limited, and Canadian Electrode Company, Limited.

The head office for this company is located in Montreal, and the laboratories at Shawinigan Falls. The laboratory owned by the Canadian Electro Products Company serves as a starting point, which laboratory will be extended as the work increases.

The personnel of the organization is as follows:

Julian C. Smith, president.

H. W. Matheson, vice-president and director of laboratories.

F. T. Kaelin, engineer.

Among the research workers are the following:

Dr. Skirrow, formerly professor of industrial chemistry, McGill University; Dr. H. S. Bennett, Cornell University; Dr. E. R. Stein, R.P.I.; M. J. Marshall, M.A., formerly instructor at McGill University; Mr. H. S. Reid, M.Sc.; W. C. Hovey, B.Sc.; F. H. Andrews, B.Sc.; G. S. Shaw, B.Sc.; Miss H. McLennan, B.A.; George Morrison, M.A.

In addition to this, there is a Technical Advisory Board, consisting of the managers of the various industries. This Board has been formed in order to give their advice on technical matters to the Laboratories Company.

The method of carrying on the work is to divide the research workers into units, each unit consisting of a chemist of considerable training, with one or two helpers, as the work demands.

This enterprise is practically the first of its kind in Canada, and the majority of the research men connected therewith are Canadians, trained in Canadian Universities.

NEW GUINEA OIL FIND.

The interesting news has been cabled from Melbourne that petroleum wells of high commercial value have been struck in the portion of New Guinea captured from the Germans. Information obtained by a party of expert investigators from America has been confirmed and amplified by Australians since their occupation of the territory. Some five months ago the Federal Minister for Home and Territories announced that the British and Australian Governments had each agreed to contribute £50,000 toward the search for oil and the development of oil fields in New Guinea.

Mercury Deposits in British Columbia.

By CHARLES CAMSELL.

THE following extracts are taken from the 1918 report of the Geological Survey, Department of Mines and through "Industrial Progress."

It is estimated that the Canadian consumption of mercury amounts to about 200,000 pounds annually. The industry in British Columbia has not been very well developed, and the field is open for more co-operative action and a larger measure of government stimulation.

Mr. Charles Cainsell has prepared a report, from which the following is taken:

"The mercury deposits of Kamloops Lake occur at intervals along a belt twenty-five miles in length, which extends from the west end of the lake northward to Criss Creek and southward to Tunkwa Lake. The principal deposits are situated in the Copper Creek Valley, one group lying at the mouth of the creek overlooking Kamloops Lake, and another group about four miles up the creek on the east side. Other deposits of less importance occur at Tunkwa Lake at the mouth of Three-Mile Creek, and also in the valley of Criss Creek.

Present Known Deposits.

"The deposits are all of similar character. They occupy fissures which have no regular or uniform strike, and which traverse both the Nicola series and the Tertiary volcanic rocks. In many places they are closely associated with dykes of rhyolite or porphyry. The veins carry cinnabar, frequently associated with stibnite in a gangue of quartz, calcite, or dolomite, which weathers to a rusty outcrop. The deposits filled what were once open fissures, for a well-fined combed structure is frequently apparent. In some places the veins have a brecciated character and in others a banded structure. Specimens indicate that the calcite and quartz were introduced after the deposition of the cinnabar and stibnite, and also after the brecciation of the veins. The walls of the veins for a few inches on either side show alteration by the solutions which passed through them.

"The deposits have probably been formed as after-effects of late Tertiary volcanic activity, and are due to the circulation of mercury-bearing waters through fractured parts of the country rocks and the concentration of cinnabar in some of the veins. As in most other cinnabar districts of the world, these deposits were probably formed near the surface, and are not likely to extend to any great depth, and in the development of the deposits this should always be borne in mind.

"No attempt was made to determine the grade of the deposits by sampling, but it is stated that in the first work of the British Columbia Cinnabar Company, in 1895 to 1896, 114 flasks of mercury were extracted in retorts from 150 tons of ore, which would make the grade of ore treated 2.9 per cent. This, however, was picked high-grade ore. The low-grade ore, as sampled by J. D. Kendall, in 1896, yielded only 0.3 per cent. of mercury. Other estimtaes of the ore range from 1 to 2 per cent.

("The property of this company consists of a group of nine, crown-granted, mineral claims, situated on the shore of Kamloops Lake at the mouth of Copper Creek. The group is favorably situated for transportation, for the main line of the Canadian Northern Railway runs through the property, and the station of Copper Creek is within half a mile of the outcrop of the deposits.

"The deposits are situated 400 or 500 feet above the lake level on an open hillside, which is timbered higher up.

"Cinnabar occurs in these deposits in a number of small veins. Owing to the drift-covered nature of the hillside and the broken-down character of all the underground workings, it was impossible to determine the number of veins, or in most cases their width. It is stated on good authority, however, that there is a considerable number of these veins with widths ranging from two inches to two feet. Sampling of these veins by the owners indicate that the grade of the ore ranges from 0.3 per cent. to about 10 per cent. The average, however, would likely be in the neighborhood of 1 per cent. The total production from these deposits during the time when the retort plant was in operation, 1895 to 1897, was 138 flasks, equivalent to 10.557 pounds of mercury. The failure of this industry is attributed to the heavy losses in the furnace and not to the grade or character of the ore.

"The Independent group is situated near Sabiston flat, about two miles west of Copper Creek. The veins are dolomitic in character, and are situated in a pink porphyritic rock which traverses volcanic rocks of the Nicola series. These rocks show the effects of considerable disturbance, and are much shattered and faulted, and the lines of fracture run in all directions. The principal vein, on which a short tunnel has been run, is about four inches wide, and the quantity of cinnabar in it is not great. No work has been done on this group for several years, and no production has ever been made.

"The Summit claim is situated near Tunkwa Lake, at the head of Three-Mile Creek, on what is called the Summer Range. The wagon road from Savona to Mamit Lake runs by the outcrop of the deposit, which is about fourteen miles from Savona. The country rock is a volcanic breccia, probably of Triassic age, which has been fractured and brecciated. Dolomitization has taken place along some of the fracture zones, and this has been accompanied by mineralization by cinnabar and a little stibnite. Later fracturing has allowed the introduction of quartz into the veins. The deposit on which the development work has been done is a vein a few inches wide, which appears to strike northeast and dips about 75 degrees to the southeast. A slight impregnation by cinnabar of the wall rocks on either side for several inches is occasionally noticeable.

"The deposit is said to run about 1½ per cent. mercury for a width of one foot. The development work consists of a shaft fifteen feet in depth and a pit about six feet deep.

"Float cinnabar was found some years ago in Criss Creek and afterwards traced to deposits in place on the north side of the creek, about four miles from its mouth. At the time of our visit these deposits could not be found and an examination of them could not be made. The rocks, however, are volcanic rocks of Triassic age, overlaid by agglomerates, tuffs and conglomerates of Tertiary age.

The former show the same bands of dolomitization as appears at the mouth of Copper Creek, and the cinnabar deposits are said to occur in these dolomite bands. Samples of high-grade mercury, stated to have come from Criss Creek, were shown us, which must have come from a vein at least four inches wide.

"Native mercury has been reported as occurring in the silver ore of Silver Peak, near Hope. It also occurs at Sechart Channel, Barclay Sound, on the west coast of Vancouver Island, in minute globules scattered through a vein of cinnabar traversing a greenish felsitic rock. Mercury has also been found in the gravels of Kicking Horse Valley, near Field, but an examination made by J. A. Allan in 1913 failed to reveal the original source of the mercury, or whether or not it was likely to be present in commercial quantities.

World Deposits.

"The United States and Mexico are the only producers of mercury in America.

"Over 70 per cent. of the mercury produced in the United States is obtained from Californian deposits. The remainder is produced in Texas and Nevada, and a small quantity comes from Oregon and Washington. These deposits are veins, stockworks, fractured zones or chambered breccia veins occurring in rocks of any composition, but mainly of Tertiary or Quaternary age.

"The deposits are generally small and decrease in size or give out in depth. They are, as a rule, confined to the upper vein zone, and many of them do not go more than 400 feet below the surface. They have been formed in late geological times, and are closely related to volcanic activity, many of them being associated with hot springs.

"The average grade of the ore now being mined in California is about 0.4 per cent. of mercury, and the cost of producing is in the neighborhood of $1 per pound. The Texas deposits run about four per cent.

"European supplies are obtained from Spain, Austria and Italy.

"The Almaden mines in Spain, which are the largest mercury mines in the world, yield mercury at a cost of $16 per flask from cinnabar ore averaging 11 per cent. mercury.

"The Italian deposits average about one per cent. and the Austrian about 0.85 per cent. Other deposits occur in Germany, Russia, Asia Minor, China, Serbia, Australia and New Zealand."

PORT COLBORNE DUST EXPLOSION.

The immediate cause of the dust explosion in the government elevator at Port Colborne on August 9th has been traced to an overheated motor. The cement structure was badly damaged and several lives lost. It would seem to be a typical case of a dust explosion, the atmospheric conditions around the heated motor being at the moment favorable. It is doubtful if any specific information which may be applied generally, further than what is generally known now, will result from the investigation.

IMPORTS OF POTASH.

It is reported by the United States Shipping Board that 10,000 tons of German potash will be imported into America from Hamburg during October and November.

MEETING OF CANADIAN TEXTILE INSTITUTE.

Members of the Canadian Textile Institute met in Toronto on September 6th at Convocation Hall, University of Toronto. The needs of the textile industry in Canada have been recently studied by Prof. A. F. Barker, of Leeds, England, and his report to the Association was inspiring. The connection between farming industries and the textile trade was pointed out, and much common ground is available for farmers and textile manufacturers. By working together the business may be built up.

The application of science to the textile industry was pointed out as a guide to progress, and every agency should work towards higher educational and technical standards. It was urged that students, during vacation, be given every chance for practical mill experience. A high grade of student, with an opportunity and proper training, will produce the most valuable asset of any industry.

Among those addressing the convention were: General Mitchell, of the Faculty of Applied Science, Toronto University; Sir Robert Falconer, President of Toronto University; Dr. Cody, Minister of Education; Dr. Merchant, Director of Technical Education; Dr. A. B. Macallum, of the Advisory Research Council, Ottawa. All these speakers pointed out the necessity for advancing technical training, and those in educational positions promised the support of the University of Toronto and the Province of Ontario.

If these plans can be reduced to a practical working basis, there is great hope that those now financially interested in the textile industry will respond most heartily to the work the Government may undertake on their behalf.

NEW COAL FIELDS IN WESTPHALIA.

Coal in strata twelve to sixteen yards thick has been found at Steinheim and Binsebeck communities in the government district of Minden, Westphalia, Germany. The mine field area is 544,646 acres, and two mining companies have been established.

OUTPUT OF ALBERTA COAL.

During the year 1918 the output of coal in the Province of Alberta amounted to 6,147,371 tons, as compared with 4,863,414 tons produced in 1917, an increase of 1,274,957 tons. In the first half of 1918 the output was 2,875,077 tons, and in the second half 3,372,294 tons.

TANKS AND DRUMS REQUIRED.

The petroleum resources of Trinidad, British West Indies, are being explored, and a large quantity of drums, tanks and tools of all kinds are required. Canadian manufacturers should get in touch with Mr. F. W. Field, British Trade Commissioner, Toronto.

PITTSBURG EXPERIMENT STATION.

On September 29th the Department of the Interior, Bureau of Mines, Washington, officially opens the Bureau Buildings at Pittsburg for inspection. A fine program of contests and visits has been prepared. On Monday a special train will run to Bruceton, Pa., where the experimental mine is located. The explosives testing plant will also be visited. On Tuesday, September 30th, mine rescue and first-aid contests will be carried out, along with demonstrations of coal-dust explosions.

METALLIFEROUS PRODUCTION IN ONTARIO, FIRST HALF-YEAR, 1919.

Statistics are now available from the Ontario Bureau of Mines from January to June, 1919. Comparative 1918 data is given below, covering common periods:

Product	Quantity		Value $	
	1918	1919	1918	1919
Gold.....ounces	229,412	231,729	4,648,164	4,666,759
Silver..... "	8,736,002	5,744,172	8,267,624	5,951,362
Platinum..... "	.....	13.6	.....	818
Palladium..... "	.....	16.4	.....	987
Cobalt (metallic).....lbs.	118,889	59,337	249,045	93,157
Nickel (metallic)..... "	208,802	5,147,745	83,332	1,825,347
Nickel Oxide..... "	21,768	5,503	5,551	1,567
Cobalt Oxide.....	259,371	202,912	339,052	301,791
Cobalt Sulphate & Hydroxide"	222,0 39	26,289	27,505	16,164
Nickel Sulphate & Carbonate"		133,732		15,531
Molybdenite, concentrates.."	32,656	.....	45,845	.....
Lead (pig)..... "	776,711	1,481,204	66,630	54,802
Copper (blister)..... "	.....	3,080,492	.....	452,055
Nickel in matte (*) short tons	21,393	7,072	12,385,950	3,535,915
Copper in matte (*) "	10,708	4,341	4,283,040	1,128,753
Copper Ore..... "	16	.....	318	.....
Iron Ore, exported (†) "	30,741	5,804	138,018	44,309
Iron, pig (‡)..... "	38,130	24,095	1,034,517	670,512
Total.....	.....	.....	31,574,591	18,759,829

*Copper in matte was valued at 20 cents and nickel at 30 cents per pound in 1918. For 1919 the values have been placed at 13 and 25 cents per pound respectively. The total matte produced contained 10,605 tons of nickel and 5,911 tons of copper. See heading "Nickel-Copper" for explanation.
†Total output of iron ore was 70,955 short tons, worth $307,645.
‡Total output of pig iron was 305,577 tons valued at $8,503,644. Figures in the table represent proportional product from Ontario ore.

Gold, Platinum and Palladium.

Gold production, 231,729 ounces, shows an increase, but is still a little under the figures for the first half of 1916, when 235,060 ounces were recovered. Unfortunately, the strike at the Kirkland Lake Camp, which began on June 12th, is still effective, and that source of gold supply is shut off for the time being. At Porcupine, however, the output is increasing, more particularly at the Hollinger, Dome and McIntyre Mines. During the half-year 490,523 tons of ore were milled, of which 465,407 were treated at Porcupine and 25,116 tons at Kirkland Lake for a recovery of 212,895 and 18,637 ounces respectively. As a by-product of nickel-copper refining at Port Colborne, gold to the value of $3,921, also platinum and palladium in small quantities, as shown in the table of production, were recovered.

Silver.

Despite the high price of silver, which averaged 103,677 cents per ounce for the half-year, production from Cobalt declined nearly three million ounces as compared with 1918. There were 28 properties from which shipments were made; those marketing one-quarter million ounces or over are named in descending order: Nipissing, Mining Corporation of Canada, McKinley-Darragh-Savage, Kerr Lake, Miller Lake-O'Brien, Coniagas, O'Brien and Buffalo. On July 23rd a strike was called by the Miners' Union. A settlement in the near future is probable, as representatives of both miners and managers are meeting in conference. Even with an early resumption of work the year's output will be materially reduced by the strike. Of the total output 42,900 ounces were recovered from gold ores and 11,714 ounces from the refining of nickel-copper matte. The Miller Lake-O'Brien and Crews-McFarlan Mines at Gowganda contributed 409,344 ounces of the total, the balance coming from Cobalt proper and Casey township. Seven shippers were paid for the cobalt content of the silver ore, receiving therefor $16,737. The ore-testing and sampling plant at Cobalt, formerly operated by Campbell & Deyell, was purchased by the Ontario Government on May 8th, and since that date has been under the management of A. A. Cole, mining engineer of the T. & N. O. Railway Commission.

Silver-Cobalt Refineries.

In addition to metallic cobalt and nickel and various compounds of these metals ,as noted in the table, Southern Ontario refineries recovered 2,659,569 ounces of silver and marketed 1,949,280 pounds of white arsenic. This production came from plants located at Deloro, Thorold, Welland and Chippawa. Nickel metal from these refineries, to the extent of 106,023 pounds, was marketed for $37,119.

Nickel-Copper.

Since July, 1918, when the production of refined nickel and blister copper by the International Nickel Company of Canada, Ltd., began at Port Colborne, Ont., the total quantities of nickel and copper in matte do not appear in the table of production. The figures given represent the shipments of matte to the United States and Wales. The close of the war found the nickel companies overstocked, and consequently the price fell and production was curtailed. Until the surplus stock has been absorbed nickel-copper matte production will not increase even to a pre-war basis. Ore smelted in the period totalled 370,541 tons, as compared with 717,119 tons for the corresponding period in 1918. Ore shipped from the Alexo Mine to the Mond Company smelter was 2,215 tons, and the British America Nickel Corporation on June 30th had 46,814 tons stock-piled.

Iron Ore and Pig Iron.

Of the total output of iron ore 65,151 tons went to Ontario blast furnaces, and 5,804 tons were shipped out of the province. The Magpie and Moose Mountain Mines were the chief producers.

Four iron furnaces at Sault Ste. Marie, two at Hamilton, and one each at Midland, Parry Sound, Port Colborne and Deseronto were in blast. Foreign ore smelted in the period was 598,581 tons, and Ontario ore 51,238 tons. The total output of pig iron was 303,577 tons, worth $8,503,644; steel, 296,081 tons, worth $8,770,717, and 23,955 tons of spiegel, valued at $868,148. The Algoma Steel Corporation now makes in its own ovens all the coke required in its plant, the output being 183,970 tons for the period.

CONFERENCE FOR DISCUSSION OF CAPITAL AND LABOR PROBLEMS.

The Dominion Government has called together representatives from organized labor bodies and employing classes for a general conference during the week of September 15th. The gathering will be held in Ottawa. The meetings will be of special interest to technical men, as representatives have been appointed from all the technical engineering and chemical organizations. It is believed that men from these classes are best fitted to assist in practical solutions of questions, as their work brings them in direct contact with all classes, and their position in industry is, in a certain sense, somewhat neutral.

TO REPLACE DESTROYED WORKS.

Belgian manufacturers are reported to be endeavoring to form a metal trust, with a capital of 300,000,000 francs, with the object of replacing the numerous works destroyed in Belgium during the war, by three or four large works.

SYNTHETIC RUBBER IN GERMANY DURING THE WAR.

Much talk was heard during the last two years of the war of the manufacturing by Germany on a large scale of substitutes for rubber. Recently, however, Dr. Duisberg, one of the directors of the Leverkusen factory, read a paper before the German Bunsen Society, which throws considerable light on the question. It was at the Leverkusen factory where most of the research and large-scale work on synthetic rubber in Germany was done. This paper shows that the reports from Germany as to her production of synthetic rubber were exaggerated. The production of synthetic rubber was attempted a number of years ago at the Leverkusen Dyeworks. Here Hoffman succeeded in producing the compound isoprene from coal-tar. This he subsequently polymerized into rubber. This was done by Tilden in 1882. However, the mere production of a substance possessing the chemcial qualities of rubber is not enough unless the new substance possesses similar physical qualities, and the consensus of opinion seems to be that the substance obtained by polymerizing butadiene, instead of isoprene, is physically much more satisfactory than any of the artificial rubbers so far produced, but the empirical formula of the resulting product can hardly be the same as that assigned to natural rubber. The dimethyl butadiene was the compound used at the Leverkusen Works, as it was found to be the cheapest and easiest to manufacture. In 1910 the price of rubber was very high, three dollars per pound in Germany, and a project was put under way at Leverkusen to manufacture rubber. Prices came down suddenly shortly after, and the factory erected for this purpose closed. Improvements were then made in the product by the use of piperidine, which proved useful in the process of vulcanizing, enabling a hard methyl-rubber to be made, as the methyl-rubber mixture first turned out was not very satisfactory. In 1914, in spite of the improvements made, the use of synthetic rubber in Germany was somewhat limited. German manufacturers seemed to prefer regenerated rubber. But as the war progressed the manufacturers were compelled to request the Leverkusen Works to turn out rubber of some kind. Tests made by the German naval authorities showed that by vulcanizing the methyl-rubber with fifty per cent. of sulphur a satisfactory hard rubber could be obtained, which was said to equal Para rubber in pressure resistance, and even twenty per cent. better as an insulator. Large orders were placed by the naval department for this rubber for accumulator-cell purposes. Lack of raw materials—acetone and aluminium—made the filling of these orders difficult. Dr. Duisberg does not state what developments in the process necessitated the use of these two materials, but it is possible that the acetone, and also the aluminium in the form of chloride, might have been used in the preparation of dimethyl-butadiene. Acetone hitherto had been manufactured almost entirely from calcium acetate, mostly imported from America prior to the war. New methods were needed with this import excluded. Before the war a small plant for the manufacture by biological methods using acetic bacteria of acetic acid was at Leverkusen. This plant was enlarged, and new works were bulit at Arensdorf for the manufacture of alcohol and acetone from potatoes, using a special culture of bacteria, known as bacteria macerans. When the supply of potatoes ran short another method of obtaining acetone had to be devised, one which had been investigated before the war, involving the conversion of acetylene into acetaldehyde, and thence into acetic acid and acetone. In addition to the small acetone plant installed at the Leverkusen Works, large plants were installed at Hochs by the Hochster Farbwerke, and at Burghausen by the Nurnberger Konsortium. In April, 1918, the output of these plants had reached 600 tons of acetone a month.

Aluminium had hitherto been imported from abroad. Buexite, it is true, had been mined in large quantities in Austria, but this had been sent into Switzerland to be

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NEW PROCESS FOR THE CONTINUOUS DISTILLATION OF TAR.

A new process was invented in 1911 by Harold P. Hird, of Dewsbury, Yorkshire, and has been patented in America as well as in other countries. Mr. Hird has already erected about one hundred and thirty plants in England, Japan and Australia, at a cost of about $1,500,000, all of which, he stated, are now working with entire success.

The Hird process is now rapidly superseding all processes for the distillation of tar hitherto used in Great Britain. The inventor claims that his plant costs less to install, occupies one-third of the previous space needed for given output, and is a cheaper process to work—in fuel, labor and wear and tear of plant—than any hitherto known in Great Britain. In one case, in Yorkshire, Mr. Hird stated, the entire cost of erecting the necessary plant and works was returned in the first twelve months' operation of it.

By the Hird process the tar is distilled continuously, each fraction being given off in uniform quality, the pitch being discharged without cessation, both process and product being free from any noxious or disagreeable fumes. The plant works automatically, and the inventor states that it can be operated by an unskilled man after only one day's training. It can also be used, if desired, for producing prepared tar for dustless-road construction, and tar-spraying which comply completely with all the British Road Board's specifications.

OIL-FLOTATION PROCESS INSTALLED.

The oil-flotation process for refining flake graphite has been installed in the Black-Donald mill at Calabogie, and the mill at Buckingham, Quebec, using this process is reported to be having great success.

OFFICIAL ENGLISH METHOD FOR ARSENIC.

Marsh's method of determining arsenic requires careful manipulation, and moreover the large amounts of reagent required demand that many precautions be taken to ensure the absence of arsenic in these reagents.

The electrolytic method consists essentially in reducing the arsenious solution by an electric current. The AsH_3 evolved is dried and decomposed by heat in the usual manner.

This method is a great improvement over Marsh's method and has been made official in England.—Ann. Falsific., Vol. II., No. 113, 1918.

BOOK REVIEWS

Manual of the Chemical Analysis of Rocks.

By *Henry S. Washington.* 3rd edition, 8vo., 269 pp. Price $2.50 net. New York, 1919. Wiley & Sons.

The American school of petrographers of which Dr. Washington is an acknowledged leader, has accomplished much in directing attention to the importance of chemistry in the problems of petrography and petrology. This new edition of the Chemical Analysis of Rocks will again prove interesting and valuable not only to beginners, but to those who may have had years of experience in the subject.

The plan of the work is similar to that of previous editions. Many of the subjects are amplified in their treatment, and new ones have been introduced. The detail given in the table of contents is useful, original sources are given in the text, and the index is very complete. The first half of the book gives much valuable information on the uses and character of thorough analytical work, under such heads as: chemistry in relation to petrology, the essential aims, habits and training of the chemist, selection of rock samples in the field, and their preparation for analysis, laboratory equipment and reagents; operations in analysis; a discussion of the accuracy and completeness of the analytical results under such titles as: operative errors, and errors of method, total summation, range of summation, etc.

The remaining half deals directly with the methods for conducting the analytical determinations. The principles involved in the accuracy and completeness of rock-analyses are now best understood by their practical application in the discussion of the main constituents of the analysis, viz., silica, alumina, the iron and alumina precipitate, lime magnesia and the alkalies.

The method described in the text for silica involves inaccuracies. First in regard to dehydration, it is recognized that silica must be blasted for twenty or thirty minutes for perfect de-hydration; still, the directions are to ignite with the Meker burner for twenty minutes, with the qualifying statement that, though the observed weight is high, this is to be "compensated" by silica that goes into solution and that is not recovered with the alumina. This procedure is difficult to explain, since it is also generally recognized that the Meker burner does not expel the water completely, and that Washington advises the regular "blasting" only, in the second edition of his work. The principle of "compensation" is dangerous in practice, and should not be entertained. Again, the total silica must be actually separated in the process of analysis and not estimated in part by "compensation." Two evaporations (and preferably three) yield the main silica precipitate, to which is to be added the silica which has been precipitated with the iron and alumina. This latter silica has been dissolved in large measure in the solution of the pyro-sulphate fusion of the ignited iron and alumina, and should be completely separated according to the method of Hillebrand, by evaporation to fuming of the sulphuric acid, and resolution of the salts by the addition of water and further heating, and the final separation of usually two or three or four milligrammes of silica. It is now possible also to obtain the correct weight of the iron and alumina precipitate (and that of alumina), after first deducting the weight of this separated silica.

Dr. Washington's process for separating silica from the iron and alumina precipitate is imperfect; it involves dissolving the pyrosulphate fusion directly in acidified water and filtering from "a few flakes of silica" "seldom more than a milligramme," but leaves, generally, more than two or three milligrammes in solution, which can be recovered, however, by Hillebrand's method, as outlined in the preceding paragraph. It is evident that Washington's process fails to give the true weight of the iron and alumina precipitate, for (assuming that the small amount of iron and alumina has been recovered from the filtrates from the iron and alumina precipitate, and enclosed with the main precipitate), the ignited precipitates now have then an excess weight which is made up of the silica remaining to be separated by Hillebrand's sulphuric acid treatment. This will then incur a direct positive error in the alumina of from three to four-tenths of one per cent.

As regards the ignition of the silica by the Meker burner, this method will likely result in more moisture being retained by the silica than, say, one milligram, if not three or more, so that this very uncertain "compensation" will give variable errors of greater or less magnitude. The author assigns no quantitative value to this "small amount of silica."

The inability of one fusion in the Lawrence Smith method to recover all the alkali had been investigated, especially in its relation to rock-analysis, by Connor (XII Cong. Geol. Int., C.R. pp. 888-890, 1913). It is therein shown that when the alkalies are determined in one-half gramme samples by the Lawrence Smith method, and the operations are conducted with the greatest care (using but one fusion, as was the universal custom), there is recoverable from the washed cake by the process of a second fusion, a constant amount close to three milligrammes, of alkali chlorides, and this amount appears to be independent of the total amount of alkalies present in the sample. Holland (page 225 Mellor) has completely verified the results obtained by Connor. Holland shows that a refusion of the washed cake yielded a constant quantity of about 3.4 milligrammes of alkali chlorides, when 1 gramme portions were used in each of five rock samples, whose total alkali content ranged from .1118 g. to .2472 go. So that the results of both investigators agree in showing that the amount of alkali recoverable by a second fusion is in each case a constant independent of the amount of contained alkali in the sample, and the final result is that determinations of the alkalies by one fusion of half-gram samples are deficient to the extent of three-tenths of one per cent. alkali oxides (calculated on the whole rock sample) and about half this percentage when one-gram samples are used.

The necessity for making a second fusion for the recovery of alkali might naturally have been included as an essential feature of every alkali determination, in Dr. Washington's description of the Lawrence Smith method, recognizing as he does its applicability to "highly accurate work." Our reference to the alkali determination would not be complete without noting also the omission of a second precipitation of the lime as carbonate, from the aqueous solution of the fused cake, as otherwise, notable amounts of alkali are held up by the lime salts at this point. This has been pointed out by Dr. Hillebrand.

These detailed references to the determinations of silica, alumina and alkalies are to show not only in what way any one of these determinations may be performed to afford accurate results, but also the inter-related character. of this work, where the main determinations may be considered as the framework, which demands that it be as nearly perfect as possible, so that when full number of

determinations are made the structure of the total analytical results shall exhibit accuracy and completeness. The contention here is that each of these main determinations must be determined as accurately as possible and regardless of relative petrographic values, for the reason that the accuracy of the determination of a petrographically less important oxide may influence the accuracy with which an oxide of greater petrographic value is determined; and further, accuracy must be maintained throughout, in order that the total summation may, if possible, be of some real assistance as a criterion of the analytical work. The problem of discovering constant errors is always present, and it is possible for constant errors of operation and of method to exist side by side in different determinations, but in different directions, so that the effect on the total summation is masked while serious errors exist. For example, adsorption of alkali salts in precipitates may yield constant errors of minus value in alkali determinations because it is the filtrate and not the precipitate that is used here, and plus errors in the weight of ignited iron and alumina, because the precipitate and not the filtrate contains the mass that is weighed.

In conclusion, it may be said that detailed instructions are given for determining the major, and many of the minor and rare constituents, so that the chemist or beginner will find much to help where assistance is really needed. The methods for estimating titanium and manganese are a boon to the analyst.

One misses throughout the book, sketches of apparatus that are often helpful through the suggestions that are to be derived from original designs, or other forms that are not to be seen in the catalogues.

Rock analyses by engineers and petrologists generally should lead to appreciation of their value, and while serving valuable ends in the progress of study, cannot, of course, take the place of analyses by experts. The completeness and absolute reliability of expert analyses form the basis of further intensive study and criticism, which is not expected from the analyses of the occasional analyst.

Years are required to co-ordinate the facts of experience in chemical analysis, to recognize variations when they occur and to understand the conditions and associations underlying them. The experience of the novice is often similar to that of one who implicitly follows a recipe without knowing the possibilities with which he is dealing in his work—the *raison d'etre* of the operations that are being carried out.

One essential, however, is this, that the beginner should exert every effort to attain the accuracy of the main framework of the analysis. Even this simple structure is not easily obtained, unless he follows carefully the instructions given, and will not let philosophising dictate changes in the methods before him, unless actual experiment proves their worth.

Altogether, we welcome this volume as an advance in the literature of this special subject, and join with the author in "hoping that the many sources of error and the many precautions which have been enumerated, will not induce discouragement at the outset, but that they will rather serve to stimulate to greater and more active and intelligent interest in, and understanding of, the analysis of rocks."

M. F. CONNOR.

The Chemists' Year Book, 1918-19.

By *F. W. Atock* and *L. Whingates*. Sherratt and Hughes, 34 Cross Street, Manchester. 2 vols. 15s., 16s. foreign.

The war has produced and expanded many little handbooks on chemistry written in English. The fourth edition of this useful Year Book has been further revised and now contains many new sections of value to those who are required to have a moderate amount of data on a variety of chemical subjects always at hand. These books are necessities and should save much time and many trips to libraries when in doubt on points connected with general analytical and industrial work.

EXPLORING FOR OIL IN THE WEST.

It has long been known that Canada possesses great areas of rich oil-bearing shales and sands. Promising areas were known to exist, but little was done to explore thoroughly the petroleum resources of the Dominion and to make the products available for commercial purposes.

Canada is now experiencing the greatest oil prospecting season in its history, and before the end of the current year the investigations of geologists who are now in the field will either prove up or definitely eliminate large tracts of land that have been looked upon as possible sources of petroleum.

Imports of oils into Canada, as shown by recent reports, are exceeded in value only by iron and steel, and coal. For the twelve months ending October, 1918, the import movement of oils was at its height, amounting to $43,275,576, comparing with $31,199,047 for the year ending October, 1917, and $19,670,503 for the similar period terminating October, 1916. The import movement of anthracite for the year closing October, 1918, was $25,680,108, while the value of imports of bituminous was $45,029,212. The importing of huge quantities of petroleum valued at many millions of dollars is an unsound policy, if Canadian resources are lying untouched that might be developed to advantage. It is estimated that the known oil deposits of the world will not last more than a few decades at the present rate of consumption.

There is general belief that the provinces of Alberta and British Columbia are the most fruitful fields for exploration. Canadian, American and British interests are actively prosecuting operations in various parts of these provinces. The results of prospecting up to date have not been sufficiently definite to warrant extravagant claims being made. There are favorable indications in several districts of Alberta, and a number of conservative companies feel justified in expending large sums of money on development, asking no special concessions from Governments and expecting no preferential treatment.

Definite Data Expected Soon.

The scene of prospecting activities extends from close to the 49th parallel to the Arctic Circle. Within that vast extent of territory there are numerous parties of prospectors at work. There is not a great deal more information available at present than there was at the beginning of the season, but the passing of the next three months will probably see developments of an important character. Much depends on the result of the wells that are now partially drilled, and which will be completed during the next month and a half.

Chemical Society News

CONGRATULATIONS FROM BRITAIN.

In the July proceedings of the Institute of Chemistry of Great Britain and Ireland the following mention is made of the Canadian Institute of Chemistry:

"The attention of the Council has been directed to the inauguration of the Canadian Institute of Chemistry, with headquarters at Montreal, and with aims very similar to those of the Institute of Great Britain and Ireland. The founders proposed originally to adopt the style of the Institute of Chemistry of Canada. The Council, on hearing of the movement, conveyed their good wishes for the success of the new Institute, but suggested that, in order to avoid possible misunderstandings in the use of distinctive initials indicating membership, the title should be changed to the 'Canadian Institute of Chemistry,' to which the founders of the new Institute have cordially agreed. The Council congratulate the new organization on its inauguration, and will be ready at all times to co-operate with it in the interests of chemists."

OBITUARY

Mr. William J. Wilson, B.A., Director of Chemistry at the Central Technical School, passed away at his home in Torrance, Ont. Mr. Wilson was born near Hamilton 43 years ago, and was educated in Toronto. He was a member of the Technical School staff for twenty years, and for the last eleven years he held the position of Director of Chemistry, and was considered one of the best science teachers in Ontario. He underwent a serious operation about last Christmas, from which he never fully recovered. He is survived by his wife.

THE CONVENTION OF FOUNDRYMEN.

The 1919 convention of the American Foundrymen's Association will be held in Philadelphia, September 29 to October 4. The Shawinigan Electro Metals Co. of Montreal will be present, demonstrating the latest uses of magnesium in foundry practic. In a recent publication of this company the possibilities of magnesium and methods of using it are outlined.

OLIVE OIL PRODUCTION.

The Malaga district produces more olive oil than any other region in Spain, which is the country which has the largest yield of olive oil in the world. According to the 1918-19 statistics of 3,851,288 acres of olive trees in the kingdom, the acreage of the Malaga district was 893,665 acres. The total yield of olive oil was 74,976 metric tons (21,719,582 gallons) out of a total production of 255,202 tons (73,928,734 gallons) in the whole of Spain. Other important olive oil producing districts are the adjacent region of Western Andalusia, which includes Seville and Cataluna in the north.

PERSONALS

The Food and Drug Laboratories of the Department of Trade and Commerce, Ottawa, were officially transferred to the new Department of Public Health, dating from August 15. These laboratories employ a number of public analysts and are located at Vancouver, Winnipeg, Ottawa and Halifax.

J. M. Wardlaw has joined his father, Mr. T. D. Wardlaw, in the well-known business which has been carried on under the latter's name for so many years at 23 Scott Street, Toronto, in aniline dyes and supplies for the tanning industry. In future the name of the firm will be T. D. Wardlaw & Son.

Mr. Jesse G. Miller, vice-president of the Basque Chemical Production Company, Limited, 509 Richards Street, Vancouver, was a visitor in Toronto last week.

Dr. Williams and Joseph Keele, of the Mines Branch at Ottawa have gone from Cochrane to James Bay. It is understood that they are examining the clay deposits on the Matagami, and will also investigate rumors of the possibility of oil being found.

Mr. Richard Neuhaus, for many years in technical charge of plant operation for the Electro-Bleaching Gas Company, Niagara Falls, N.Y., has taken charge of the new department for the design and construction of the special equipment necessary for the generation and handling of commercial gases, recently created by the Hercules Engineering Co., New York.

Arthur Frerrault, of the Brown Corporation, La Tuque, Quebec, was drowned while attempting to rescue his two sons in the Bastonnais River, near La Tuque. All three were drowned.

Mr. A. G. McLaren, for some time with Mr. H. W. McCurdy, wholesale chemicals, Toronto, has become associated with Mr. Allan O. Thorne, import and export chemical broker, Mail Building, Toronto.

MUSSEL MUD AS A FERTILIZER.

One of the Bills referred to by the Lt.-Governor of P.E.I., in the speech from the throne, at Charlottetown, dealt with a measure for Government assistance in dredging the sea shore for the mussel shell and oyster shell deposits, commonly known as mussel mud. For nearly half a century the farmers along the shores of Prince Edward Island have dug the mussel and oyster beds for the decayed shells which afford carbonate of lime. A certain amount of silt mixed with these deposits is understood to be of value for fertilizer. The dredges were usually small affairs operated by horse power, and the mud was loaded on wagons or cars and distributed among the farmers. Some years ago the Provincial Government provided a larger dredge which was at the disposal of the community when not needed for Government work. The large deposit at Midgell, being nearly exhausted, it is proposed to dredge at other places with Government assistance.

Apart from the carbonate of lime in the shells the real value of these deposits has not been determined. There is of course more or less soil nutriment in the silt washed down from the rivers and mussel beds near a river mouth would get the benefit of this. Much would depend on the ammonia content of the silt, which might be worth $8 or $10 a ton. It would require 5 to 10 tons of the wet stuff to make a ton of dry material. Analysis of the mud would be instructive.

INDUSTRIAL SECTION

Construction, Manufacturing and Market News

British Columbia.

Burnaby.—The Alexander Cunningham and Gregory Tire and Rubber Company is considering building a plant at Burnaby, and an agreement between the company and the town is now being made. This is said to be the first rubber plant to be erected in Western Canada.

Courtenay.—Kelly, Douglas & Co., of Vancouver, are planning an extension to their condensed milk plant here, to cost $25,000.

South Vancouver.—Gregory Tire & Rubber Co. have selected a site for the erection of a tire factory.

Vancouver.—The Electrical Manufacturing Company have taken out a permit for the construction of their new factory building on Granville Island. The estimated cost is $5,000.

The Fraser Valley Dairy is building an addition to its Vancouver plant, to cost $6,500.

Manitoba.

Winnipeg.—Gordon, Ironside & Fares will construct an addition to their present plant. Estimated cost, $10,000.

The Burgess Battery, Ltd., have opened a factory at 701 Wellington Ave., for the manufacture of dry cell batteries. The head office of this company is at Madison, Wis. L. R. Baker, formerly associated with the Canadian Dry Cell Co., has been engaged as manager of the new plant.

Nova Scotia.

Halifax.—An abattoir is planned by the Maritime Stock Breeders' Association.

Sydney.—A contract for 250,000 tons of ships' plates, involving five years' work and the completion of the erection of a large rolling plant at Sydney, N.S., costing in the vicinity of five millions of dollars, was let recently to the Dominion Steel Company by the Federal Government, according to an announcement by Hon. C. C. Ballantyne, Minister of Marine.

Ontario.

Brantford.—The Brantford Roofing Co. has commenced construction of an extension to the boiler plant. Estimated cost, $5,000.

The Brantford Scale Co. has awarded a contract for erection of an addition to their present plant. Plans are being prepared to double the capacity of the plant by further additions.

The United Portland Cement Co., Ltd., has been incorporated with head offices at the town of Brantford, to manufacture and sell Portland cement. The stock of the company is $200,000, divided into 2,000 shares of $100 each.

An industry for the manufacturing of hard rubber goods will probably be located here. Edwards & Co. of Toronto, brokers, are the promoters.

Chatham.—The Canadian Des Moines Steel Company has the contract for the construction of eight wireless towers in France.

Cooksville.—The Shale Brick Company of Canada, Limited, Toronto, announce they are now operating their plant at Cooksville, Ont., formerly owned by the Ontario National Brick Company, Limited.

Dunnville.—Canadian Engines, Ltd., manufacturers of stationary and portable gas and gasoline engines, who were practically closed down during the war, have resumed operations, and are taking on a full complement of men. They report that the prospects are favorable for a busy time throughout the year.

Fergus.—Beatty Bros. plan extensions to their factory to cost in the neighborhood of $35,000.

Galt.—The R. McDougall Co., Ltd., have resumed full operations following the fire at their plant.

The Galt Brass Co., Limited, have been incorporated with an authorized capital of $500,000 to take over the liabilities and carry on the business of the Galt Brass Company, Limited, Galt. They expect to develop and expand the business considerably.

Georgetown.—H. Corke & Co., Ltd., have been incorporated with a capital stock of $100,000, divided into 400 shares of $25 each, to carry on the business now carried on by H. Corke & Co., Georgetown, manufacturing woollens and cottons.

Guelph.—Letters of incorporation have been issued to Charles Lawrence Dunbar, Leo William Goetz and others to acquire the business of oxyactylene welders and machinists formerly carried on in Guelph by R. B. Lang and John Skidmore, and to do business under the name of the Lang Manufacturing Company, with a capital stock of $40,000.

Contracts have been let by the Lang Manufacturing Co., of Guelph, for the erection of a new machine shop to be built on the Harris St. side of their present factory.

Hamilton.—An addition, to cost $6,000, will be built by the Garton Brush Co.

The Acme Stamping & Tool Co. are making an addition to their plant.

The Dominion Foundry Co.'s plant was closed down for two weeks in July while electric ovens were installed. It is reported that the company intends to operate rolling mills in the course of a couple of months.

A company has been incorporated with a capital stock of $24,000, known as the Canadian Type Registering Scale Co., Ltd., with head offices at Hamilton, to manufacture scales and type-registering devices.

Contracts have been let in connection with the erection of an addition to the factory of the Mercury Mills, Ltd.

The Steel Company of Canada has voted all its employees a 10 per cent. increase in pay.

It is rumored that the Dominion Canners, Ltd., will build a one-million-dollar factory here.

Hanover.—Hanover Portland Cement Co. intend remodelling their plant and installing additional equipment.

Ingersoll.—The Royal Broom Co. will start operations as soon as the necessary repairs are made to factory.

Kitchener.—One hundred gallons of gasoline exploded at the plant of the Canadian Consolidated Felt Co. on August

14, and two men were killed and several hurt. The impregnation plant and a garage were totally destroyed.

A new packing plant and abattoir will be erected on Guelph St., by Dumart Bros. Estimated cost, $75,000.

The Lang Tanning Co. propose to make additions to their plant of two buildings each 100 by 200 feet, four-story brick construction.

The Canadian Consolidated Rubber Company will spend $1,000,000 on improvements and additions to their plant.

The Dominion Tire Co., 149 Strange St., will erect a $150,000 addition to their factory.

London.—An addition will be made to the factory of W. A. Jenkins & Co., Ridout and King Strets.

The C. S. Hyman Co., tanners, will erect a new building on George Street.

Niagara Falls.—Hamilton Lindsay, Alexander Winton, George Hayes Brown and others of Cleveland, Ohio, have incorporated the Niagara Wire Weaving Company, with a capital of $220,000, for the manufacturing of wire cloth.

Oshawa.—The General Motors Co. of Canada, Ltd., will erect a million-dollar plant here.

The Pedlar People, Ltd., are proposing to build additions to their present factory, but removing the whole plant to a new site. They have offered their present location to the town to purchase for park purposes.

Peterboro.—The Albion Knitting Co. plans alterations to its factory.

Picton.—A new factory will be built by Kinney & Colliver.

St. Mary's.—Mills are to be erected by the St. Mary's Milling Company.

Sarnia.—The Premier Paper Products, Ltd., have been incorporated with head offices at Sarnia. The capital stock will be $650,000 in 500 shares of $100 each. The company is to manufacture and deal in paper cardboard and other products of paper or pulp, and engage in a general lumber business.

Sault Ste. Marie.—The extension of the rail mill of the Algoma Steel Co.'s plant, announced in our August number, will cost several hundred thousand dollars, and is but the beginning of an extensive development of the plant. The plan laid out by the company involves an expenditure of from five to seven million dollars.

Sharbot Lake.—A creamery will be erected here by the Belleville Creamery, Limited, Belleville.

Thorold.—The Beaver Board Co. will expend $2,500,000 in the expansion of the Thorold plant, as well as building a duplicate of the Ottawa plant to take care of the increased Canadian and export business.

Toronto.—The Jefferson Glass Co. are planning to make extensions to their plant.

The Canada Petroleum and Refining Co. has been incorporated with head offices in Toronto. The capital stock of the company is to be $2,500,000, divided into 2,500,000 shares of $1 each, and the company is to carry on a general business in crude petroleum and its products.

Additions are being made to the plant of A. R. Clarke & Co. on Eastern Ave., and the Toronto Carpet Mfg. Co., 1179 King St. W.

The new steel rolling mill, which will be located on the British Forgings site at Ashbridge's Bay, by Baldwins, Limited, of Swansea, Wales, will be known as Baldwins Canadian Steel Corporation, Limited. Mr. A. M. Russell, of Hugh Russell & Sons, Montreal, is to be president of the new company, which will provide employment for 2,300 men by the end of August, 1920.

The silver workers' strike ended August 26, all men returning to work. The employers granted the increased wages asked for, except in the case of helpers. The new scale is: expert craftsmen, 60 cents per hour; helpers, 40 cents per hour for first six months; then 45 cents, and at the end of one year's service, 50 cents. All men to work 48 hours per week.

The Anthracite Briquette Company will start building immediately on the new industrial site of the Toronto Harbor Commission a factory for the making of compressed anthracite briquettes. Large supplies of waste anthracite have been secured and the plant will have at first a capacity of ten tons per hour. The rights of a patented binder have been secured from the United States.

The John Wood Manufacturing Company of Conshohocken, Pennsylvania, have purchased the plant of the Holden-Morgan Thread Miller Company on Coxwell Ave., Toronto, comprising three and three-quarter acres, with two large mill buildings and several smaller ones, and will engage in the manufacture of welded range boilers, storage tanks, gasoline tanks and similar goods. It is their intention to begin work as speedily as possible, and they expect to be in production early in September.

Walkerville.—The Peabody Manufacturing Co., Ltd., will erect a $500,000 textile plant here.

Windsor.—Plans have been prepared for a factory to cost about $30,000 for B. N. Marsh.

Port Arthur.—The first shipment of silver ore from the Northern Ontario district has been made after a lapse of years from the West End mine, by the Mining Corporation of Canada. Four other mines of the corporation are expected to open again shortly.

The McKenzie-Rawn operators at Steep Rock Lake, near Atikonan, report an important discovery of hematite ore. A seam of ore-bearing quartz, 40 feet in thickness, has been uncovered, and is thought to mark the beginning of active iron ore development in this district.

Goderich.—Following several weeks of negotiations, a site has been secured for the location of the big steel industry of the Lake Huron Steel Corporation. The site is at the south end of the town, partly in Goderich township, and comprises 250 acres along the shore of Lake Huron. Surveyors are already laying out the site. More than two million will be spent in the next twelve months, and an additional six millions in the second year in establishing the plant, which will include six electric furnaces for the manufacture of steel products.

Quebec.

Clarke City.—The Gulf Pulp & Paper Co., Ltd., will soon erect addition to plant.

Montreal.—The new news-print mill of the Spanish River Pulp Co. is now completed. One set of machines will be in operation by November 1st, and the second set by February 1, 1920, giving a daily output of 100 tons.

The Laval Industrial Co. contemplates the erection of stamping works to cost $25,000.

The Dominion Oilcloth Co., 1192 St. Catherine St. E., has awarded the contract for a $30,000 warehouse to J. Meloche, 1911 Masson St.

The Anglo-Canadian Wire Rope Company, Montreal, has been incorporated with a capital stock of $200,00 by Alexander Chase Casgrain, Errol McDougall, Leslie G.

Bell and others to manufacture wire and wire products.

Contract has been let for a $12,000 foundry building for Canadian Steel Foundries, Ltd.

Milton L. Hersey, Henry H. Vaughan, Walter A. Jannsen and others have taken out letters of incorporation as the General Combustion Co. of Canada, with headquarters at Montreal, with nominal capital of $100,000, with the intention of manufacturing electric furnaces and electric heating devices, etc.

The recent reorganization of the St. Lawrence Welding Co., of Montreal, places the control of the company in the hands of W. H. Barry and A. M. Barry, president and general manager respectively; F. E. Fox being appointed a director and secretary-treasurer. L. E. Moulton is also a director of the new firm. The plant here has been enlarged and a well-equipped machine shop added to carry out the complete repairs of all welded work.

Quebec.—An option was secured on August 18, for 30 days, on property near Sillery Cove, for the erection of a nine-million-dollar pulp mill. The promoters are well-known United States financiers and pulp men.

Plans are being prepared for a $500,000 factory for the Marceau Oil Cloth Co.

St. Lambert.—Contract has been let by the L. E. Waterman Co., Ltd., for $100,000 factory and office building.

Sherbrooke.—Contract has been let for a factory to cost $50,000 by the Dominion Cartridge Co., Limited.

Three Rivers.—The Three Rivers Shipyard Co., have started work on a new machine shop on Notre Dame St. Frame and brick.

Saskatchewan.

Melfort.—The Saskatchewan Co-operative Creameries, Limited, are erecting a $50,000 creamery here.

Regina.—A warehouse costing $75,000 will be erected here by the Goodyear Tire & Rubber Co. of Canada.

Foreign.

France.—The Vulcan Steel Products Company of New York has been awarded a contract for the rebuilding of the war-ravaged district of Nancy at an estimated cost of $250,000,000, which may be increased to $500,000,000 before the contract is completed. Associated with the Vulcan Company in the contract are the McClintick-Marshall Construction Company and the MacArthur Bros. Company, both United States firms. The ocntract calls for the reconstruction of public buildings, factories, dwellings, roads and bridges.

Belgium.—The first Belgian blast furnace to be relighted since the armistice has recently been started at the Usines de la Providence, Marchienne-au-Pont. Four of the furnaces of this company were destroyed by the Germans, and the fifth, which has just been relighted, was denuded of all its fittings, which were either destroyed on the spot or removed to Germany.—Board of Trade Journal, London, Eng.

Germany.—The German firm of A. G. Gerresheimer Glashuttenwerke of Dusseldorf has purchased the Dutch bottle factory at Capelle, on the River Ijsel. The purchase price of fls. 130,000 was paid from available funds.

The Berliner Tageblatt comments on the above report as follows: "It is curious that a company, which recently announced in a circular that, owing to the pending exhaustion of the working finances the industry would have to close down entirely, can pay from available funds a sum of fls. 130,000 (570,000 marks) for a foreign concern."

The Berliner Tageblatt states that this action of the Dusseldorf Company is a transference of capital abroad, which must be stopped by all available means.

Mexico.—There should be a very considerable demand for sodium and potassium cyanide in the Zacatecas district as soon as conditions permit the mining companies to restart their reduction plants. At the present time there are two mills in operation. Between them their cyanide consumption will be roughly eighteen tons per month. The district consumption might be calculated at forty tons monthly.

In view of the expected enlargement of the oil industry in Mexico there should be a considerable increase in the demand for tinplates from South Wales, although they will meet with heavy competition from other countries.

APPOINTED SALES AGENTS.

The A. G. Watt Co., Park Building, Cleveland, Ohio, have been appointed as representatives and sales agents in the mid-western territory for Hummel & Robinson, manufacturers and importers of chemicals and dry colors for the paint, varnish and rubber trades. Mr. A. G. Watt has been connected with E. M. & F. Waldo, New York, and prior to that was with Sherwin-Williams Co., acting most of this time as Assistant General Purchasing Agent.

The Industrial Chemists of Glasgow.—That there were no members of industry who required to better protect their interests than those who were industrial chemists, was the opinion expressed by Mr. C. N. Exley, president of the Glasgow and District Section, Scotland, of the National Association of Industrial Chemists, at a recent meeting of the section. Mr. Exley pointed out that the National Association, by a large majority of its members, was being registered as a trade union, and he believed this to be a proper step, as such rating would give them added powers in many directions. It was proposed to affiliate with one of the bigger unions, namely, the Association of Scientific Engineers, and the Executive Council of the National Association of Industrial Chemists had already approved of a scheme of affiliation submitted by the General Secretary of the Scientific Engineers. Mr. Exley favored the proposal as submitted. One of the special objects of the National Association was to deal with the position and status of the younger chemists with regard to the question of salary and over-working conditions. In many works industrial chemists were not paid in accordance with the important work for which they were responsible. They wished to raise the position of the industrial chemist to a status of a profession. Industrial chemists for many years had been very badly paid, and the only remedy lay in the direction of unity.

A number of those present voiced their views along lines similar to those of Mr. Exley, and it was decided that the section should get into close contact with all industrial chemists in the Glasgow and West of Scotland area, making the local section as strong as possible. The meeting supported the registration of the National Association as a trade union.

Canadian Government Publications.

By S. J. COOK, B.A., A.I.C., PUBLIC ANALYST, DEPARTMENT of TRADE and COMMERCE, OTTAWA.

(NOTE: Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

DEPARTMENT OF AGRICULTURE.

Farm Feeds. By Frank T. Shutt, M.A., D.Sc. Dominion Chemist. 48 pp.

The nature and composition of the various kinds of grains, mill feeds and concentrates on the market have been the subject of so much inquiry recently that this easily readable bulletin on the subject has been prepared from the records of the analyses made in the chemical laboratories of the farm, for the use of the farmer and others interested in the feeding values of grain products on the market. The classification is according to the component materials and the discussion accompanying the analyses makes the publication effective.

Home-Grown Seed of Annual Vegetables. 4 pp.—Simple instructions for the successful growing at home of many common vegetable seeds.

Seasonable Hints. July. 16 pp.—Hints from the various branches of the Department intended to be of value to all agriculturists.

COMMISSION OF CONSERVATION.

Conservation in 1918. By James White, F.R.G.S., Assistant to the Chairman of the Commission. 88 pp.

A review of the work of the Commission of Conservation during the year as presented by Mr. White at the annual meeting of the commission last spring. This is a reprint from the more bulky work, the annual report, and is published in this form for public distribution. It gives in readable form a very excellent resume of the many activities of the commission and contains much information regarding the conservation and proper utilization of our natural resources. Appended to the report are five special chapters, the first of which deals with the subject of aluminum in Canada, which covers some 13 pages and is replete with information. The remaining ones consist of (1) Order-in-Council, 2nd September, 1918, re Application of the St. Lawrence River Power Co.; (2) Argument of Hon. Hugh Guthrie in this matter; (3) Interim Order of the International Joint Commission; (4) Order-in-Council October 12, 1918, re St. Lawrence River Power Co. These cover the story of the diversion of water by the submerged weir in the St. Lawrence for the purpose of enabling a certain company to increase its production of aluminium, and thus form a valuable addition to the report on conservation to which this story is directly related.

INTERNATIONAL JOINT COMMISSION.

Hearings: In the Matter of the Application of the St. Lawrence River Power Co. 305 pp. 14 illustrations.

The hearings before the commission to which reference was made in the foregoing review, are given in this publication in full. These hearings were at Atlantic City on August 12th, 1918, and at Montreal on August 29th, 1918. The appendix to the hearings contains all the orders and acts referred to and thus completes the record so that any one who wishes to familiarize himself with the details of this interesting case may do so. There are a number of illustrations which serve a very useful purpose. Altogether this international dispute as to who controls our boundary waters is one of the outstanding subjects of international interest, and it is not surprising to find the Webster-Ashburton Treaty constantly referred to throughout.

Opinion by Mr. Powell. Interim Order and Opinion.—These two pamphlets of about twenty pages contain the results of the hearings referred to.

DEPARTMENT OF THE INTERIOR.

Forest Fires in Canada, 1917. Bulletin 68, 24 pp.—The available statistics on this subject are given in this pamphlet in graphic form. The data given are not complete, but serve as a partial guide to the destruction caused annually by this menace which is so inadequately dealt with.

DEPARTMENT OF MINES.

Mines Branch.—Potash Recovery at Cement Plants. Bulletin 29. By Alfred W. G. Wilson, Ph.D. 34 pp. 10 plates.

Under the auspices of the War Trade Board, Dr. Wilson undertook a survey of the plants in which potash recovery apparatus had been installed, and the information gathered in the course of this work is given permanent record in this publication. Practically all the plants in the United States which have systems installed for the precipitation of dust were visited in the course of the investigation, and so Dr. Wilson writes from a first-hand knowledge of his subject. The "Dry Cleaning Methods," and the "Spray" systems are described, and each plant visited is mentioned in detail. Related data are given and at the end a bibliography lists the references in the literature of the subject. The plates are illustrative of the various plants seen.

Geological Survey.—The Mackenzie River Basin. Memoir 108. By Camsell and Malcolm. 154 pp., 1 map, 14 plates, 1 figure.

This is a compilation of the present knowledge of the economic possibilities of the Mackenzie Basin. The writers have drawn liberally on the existing literature, but have supplemented it with data obtained by residence in the district, and the romance of the canoe routes in this great area crops out throughout the book. The 682,000 square miles drained by the Mackenzie, constitutes somewhat more than one-fifth of the area of Canada, and in the 40,000 square miles of this area covered by water there abound many lakes, notably Great Bear, well stocked with the finest fish, as yet untouched. Under "Economic Geology" are mentioned the resources of the basin, including coal, some of which is said to be anthracite; bituminous sands, which have been worked for paving materials successfully; stoneware clays; gypsum; oil, and gas. The publication presents the story of this great North Land as it is known to-day in a very acceptable way, and it may well be read with profit.

The Harricanaw-Turgeon Basin, Northern Quebec. Memoir 109. By T. L. Tanton. 84 pp., 9 plates, 1 map, 2 figures.

The area reported upon, lies north-east of Lake Abitibi, in the clay belt, and is consequently a promising field for agricultural development. The customary careful examination of the mineral resources shows some gold, copper and

asbestos, in addition to clays which may be worked for brick-making. Several excellent plates add to the value of the memoir.

Geology of the Disturbed Belt of Southwestern Alberta. Memoir 112. By J. S. Stewart. 71 pp., 5 plates, 1 map.

Field work done during the summers of 1914 and 1915 on the area which extends from the eastern base of the Rocky Mountains for about 100 miles northwesterly from the international boundary, and covers about 2,000 square miles, is recorded in this survey. A description of the stratigraphy and structure of this region forms the principal part of the report.

Geological Survey. Memoir 110, No. 80, Geological Series. Preliminary Report on the Economic Geology of Hazelton District, British Columbia. By J. J. O'Neill. 51 pp., 5 maps, 19 plates, 5 figures.

This report is the first published account of the investigatory work undertaken in 1917 "with a view to stimulating the mineral production from this easily accessible and promising district by determining the origin, distribution, and general occurrence of the ores, and their relations to one another, to the gangue minerals, and to the various country rocks which enclose the veins."

In his summary, the author claims that "there are several properties in the silver-lead-zinc group, and in the copper-gold group, which are not being worked, and which have showings indicative of a considerable amount of milling-ore and more or less high-grade ore. These properties have been partially developed, but work on them has ceased from lack of capital, the cost of mining and shipping the high-grade material being prohibitive without returns from the milling-ore, which must be opened up or extracted in mining the high-grade ore." Further on, he comments: "It may be said that the district about Hazelton offers an excellent example of mining conditions over which a certain amount of government supervision would be of great advantage to the properties concerned and to the country as a whole. If general co-operation were made compulsory in cases like this, it would tend to more efficient development of the district as a whole, and insure a thorough test of all likely properties at a minimum of expense. It would also conserve a large amount of valuable mineral in lower grade properties, which, under present conditions, will be wasted, or rendered unavailable for extraction at a profit by the exhaustion of the more valuable properties."

The properties in the district are described and the economic geology discussed in good detail.

Annual Report of the Mineral Production of Canada for 1917. No. 504. 258 pp. This publication constitutes the report in full of the work on which a preliminary report was issued in February of last year, and gives revised statistical information descriptive of the mining and metallurgical production in Canada during the calendar year 1917. Sixteen pages of summary give the mineral production of Canada for 1916-1917 in a comparative table, a general table of exports and imports, production by provinces for 1916-1917, and the mine production for the year. Then follow in alphabetical order the metallic ores, regarding which data of interest are given under each heading. The second half of the book is given to the non-metallic products. In general, the production, imports and exports of each article listed are recorded in such form as to be easily accessible to the reader. This report is replete with information which is always in demand, and the volume constitutes, therefore, a reference of considerable value.

DEPARTMENT OF PUBLIC INFORMATION.

Bolshevism in Russia. 64 pp.—This summary has been prepared by the Department of Public Information from the collection of reports presented to the Parliament of Great Britain by command of his Majesty, and laid on the table of the House of Commons, Canada, April 29, 1919.

DEPARTMENT OF THE NAVAL SERVICE.

Sea Fishery Statistics. January-June.—Twelve pages of data re the catch and marketing of sea fish, by provinces and for the Dominion.

Fisheries Branch.—Quarterly Bulletin of Sea Fishery Statistics. 11 pp. Data relative to the catch and marketing of sea fish for Canada, United States and the British Isles.

DEPARTMENT OF TRADE AND COMMERCE.

Dominion Bureau of Statistics.—Monthly Bulletin of Agricultural Statistics. June, 1919.—Field crops, and crop reports; dates of seeding; production of flax in 1918; crop reports from other countries and prices of agricultural produce in 1919.

Monthly Reports of the Trade of Canada, April, May and June. 428 pp. each.—With the beginning of a new fiscal year, the form of these reports was changed, and the items arranged in a new and somewhat better classification. The tables are all set up vertically on the page, and new group headings have been selected with the intention of making this publication more readily useful to its readers. A few new items have been added as the result of the Department of Customs providing the new terms. This report is compiled from the returns of the customs and consequently only the items selected by the Customs Department are given. The change in classification delayed publication somewhat so that the three numbers make their appearance during this one month.

Commercial Intelligence Branch.—Weekly Bulletins Nos. 808-812 (last number, August 25, 1919).—No. 808 carries a report from Commissioner Watson, of London, on the findings of the Inter-Departmental Committee on the production of power alcohol (pages 155-162). An article on "Trade Organizations and Combinations in the United Kingdom," begun in Bulletin 807, runs through all those now reported on. It is written by John Hilton, of the Garton Foundation, and is based on evidence laid before the Committee on Trusts. This is an authentic review of the subject. No. 811 gives an account of the preliminary report upon the production and consumption of sugar within the British Empire, presented at the annual meeting of the Society of Chemical Industry in London by Mr. Arthur Ling, F.I.C. (pages 315-326). No. 812 refers to the possible production of power alcohol in Great Britain at 1s. 3d. per gallon synthetically from the products of coal distillation (page 389).

Food and Drug Laboratory.—Bulletin 427. Cloves, Whole and Ground.—Ninety-seven samples of whole cloves and 122 of ground cloves were examined. Low-grade cloves contain at least 14 per cent. volatile oil. Fifty-seven of the samples of ground cloves contained less than 14 per cent., and it is pointed out that the purchaser can form no opinion as to the real value of the spice he buys from the price asked for it, due to the custom of mixing allspice, which is cheap, with the cloves. It is recommended that standards be established for this food condiment.

Bulletin 428. Chop Feed. 5 pp.—Seventy-seven out of 120 samples meet the requirements for this class of feed.

Bulletin 429. Lime Juice. 7 pp.—Report of the examina-

tion of 60 samples of lime juice. Twelve samples failed to meet requirements of the Adulteration Act standards.

Bulletin 430. Linseed Oil and Substitutes. 12 pp.—One hundred and thirty-six samples of linseed oil and eight other samples of so-called paint oils were examined and the data found are reported in this bulletin. The report might well be called an examination of linseed oil, as the data given on the subject of substitutes, as the term is understood in the paint trade, are very meagre. It is probable that there are few products sold as "linseed oil substitute," however, although in the paints which are found on the market there are undoubtedly many oils other than linseed used in the vehicle. Comments on the various tests carried out are given, but the reader is left to make his own interpretation of the analyses. It is indicated that this report might be used as a basis of standardization of this article. It might be suggested that a number of analyses of oils of known origin and purity would furnish more reliable data for this purpose. As a guide to the quality of the linseed oil offered for sale in Canada, the bulletin is of value.

NEW DIRECTORY OF CANADIAN CHEMICAL INDUSTRIES.

The Dominion Bureau of Statistics has just issued a Directory of the Chemical Industries in Canada, listing the names, addresses and products of nearly five hundred Canadian firms manufacturing chemicals, or other products in which the processes used are essentially dependent upon the agency of chemical change.

This publication is of undoubted value to the general public, as well as to the trade. It has come to be a well-accepted truth that scientific progress is essential to the true development and material welfare of any country, and in Canada, where many of our natural resources are as yet almost unknown, the importance of laying sound foundations cannot be overestimated. Some of the possibilities of industrial chemical development were made apparent by the remarkable accomplishments along these lines in Canada during the war, and consequently popular sentiment now favors the idea that this country should, to a large extent, be freed from dependence upon other countries for our chemical needs. In order that this idea might be guided along well-advised lines, it was essential that a survey of our chemical industries should be made, and the bulletin now referred to represents the first phase of this work.

The Directory is in two divisions: (1) An alphabetical list of the various concerns, the head office address of each, together with a detailed list of their products, including in the latter chemicals and products resulting from chemical processes; (2) a list, alphabetically arranged, of the chemical products manufactured in Canada, showing the names of the various firms engaged in their manufacture.

The Directory has been published in a limited edition, and as a great number of requests for copies have already been received, it is probable that the available supply will soon be taken up. Requests from those interested should be addressed to the Dominion Bureau of Statistics, Ottawa.

SECURED GOOD PAINT ORDERS.

Orders exceeding $250,000 for Canadian paint and varnish firms were secured by Walter B. Ramsay, vice-president of the Canadian Paint, Oil and Varnish Association, during his visit to English and European concerns early this summer.

MAGNESIUM SULPHATE DEVELOPMENT.

The natural deposits of magnesium sulphate in British Columbia have received vigorous exploitation during the summer. Both the Stewart-Calvert Company at Clinton, B.C., and the Basque Chemical Production Company, at Basque, B.C., are shipping. Eastern Canadian agents of these companies are showing some very pure natural samples, and quite recently the Basque Company commenced shipping car-load lots of natural salts, guaranteed U.S.P. and B.P. grade. If freight rates allow, and the natural product is found satisfactory to the trade, a very valuable British Columbia industry has been established.

WAR CHEMICAL PLANTS.

The Imperial Munitions Board plant at Trenton, Ontario, will not be wrecked, as was first thought, but has been sold to parties whose names cannot be given as yet. It will not be entirely wrecked, but will be largely used as it stands. The I.M.B. plant at Nobel, Ontario, near Parry Sound, has been wrecked and sold. The United States munition plant at Nobel has been partly disposed of, the temporary buildings having been torn down, while the brick buildings will be left intact. The plant of the Canadian Explosives Co. at Nobel will engage in the manufacture of a new brand of dynamite, and also of aluminum sulphate for the paper industry.

The British Forgings plant at Toronto has been sold to Baldwins, Ltd., of Swansea, England, who will convert the plant into one of the largest steel rolling mills in America.

CANADIAN FILMS AT CHICAGO EXPOSITION.

On Monday night, September 22nd, the Province of Ontario will show a general film, "Mining in Northern Ontario" This has been prepared by the Ontario Government Motion Picture Bureau, and has not been previously shown. On Thursday a special film, "Cum grano salis," showing the entire processes of the Canadian Salt Company, Windsor, will be given.

MERCURY IN BRITISH COLUMBIA.

Development of the mercury resources in British Columbia is a possibility, according to a Geological Survey report issued by the Department of Mines at Ottawa. The paper in question was prepared by Mr. Charles Camsell, and it indicates that the deposits of mercury are extensive in the coast provinces. Copper Creek Valley is the principal field, and one deposit is stated to be near Kamloops Lake, and another about four miles up the creek on the east side. Other deposits of less importance occur at Tunkwa Lake, at the mouth of Three-mile Creek, and also in the valley of Criss Creek.

The Dominion Water-Power Branch proposes to establish an information bureau regarding Canadian water-powers at the Exposition of Chemical Industries, to be held during the week of September 22nd in Chicago. Space has been secured in the Canadian section on the main floor of the Coliseum, and the bureau will be in charge of Water-Power Branch officials, who will supply up-to-date information concerning water-powers in any region to all interested persons. Copies of printed reports will also be available for distribution.

NEW YORK LETTER

Special Correspondence to the Canadian Chemical Journal by F. M. Turner, Jr.

New York, August 28th, 1919.

Dr. Charles H. Herty, former president of the American Chemical Society, and at present editor of the Journal of Industrial and Engineering Chemistry, has been commissioned by President Wilson to make a trip to Germany as special representative of the United States to arrange for a supply of vat colors that are not at present being manufactured by American dyestuff manufacturers and are seriously needed in this country. Dr. Herty will go abroad as soon as necessary travelling arrangements can be made, and will be assisted in his work by American officials in the occupied portion of Germany, in which most of the larger dyestuff manufactories are located. The War Trade Board will have charge of the distribution of the dyestuffs after they reach this country. In this way an impartial allotment of these much-needed materials will be made to all concerns requiring them. A questionnaire has been sent out by the National Association of Shirt Manufacturers, who are chiefly in need of fabrics dyed with these vat colors, to numerous cloth printers and dyers. Every effort will be made to hasten the arrival of the vat dyes in this country, as the stocks held here are very near exhaustion. Vat dyes are absolutely necessary for fabrics which are used in washable materials. American manufacturers are familiar with the processes for making these dyes, and it is expected that importation from Germany under special license will only be a temporary provision and that America will soon have an ample domestic supply. In the meantime, however, American manufacturers of shirts, etc., must not be handicapped, especially in the export markets, by lack of these dyes. The reason these dyes have not been made here up to date is that the dyestuff manufacturers have been kept busy producing other much-needed classes of dyes, the manufacture of which was simpler and consequently more adapted to the young dyestuff industry in America. Consequently, the intermediate products necessary for the vat dyes have not been available in quantity. In one of the New York daily papers Dr. Herty is quoted as saying: "Within six months I expect the American dye-makers will be able to turn out vat dyes in quantities large enough to provide for the wants of domestic consumers. Meantime the available supplies here have become so reduced that immediate steps to relieve the shortage are necessary. The plan adopted by the War Trade Board to bring over enough German vat dyes to supply the textile industries for a period of six months is fair and satisfactory to all interests. Every effort, I am sure, will be made to expedite shipments to this country."

A.A.C. Annual Report.

The annual report of the American Agricultural Chemical Company shows manufacturing profits for last year of $8,035,854, as compared with $11,079.956 the previous year. After federal taxes, charges and preferred dividends have been paid a considerable surplus is left, in spite of the fact, stated by Peter B. Bradley, president of the company, that the company suffered seriously by adverse conditions during the readjustment period following the close of the war. The principal products of the company are fertilizers and sulphuric acid.

The Mason Coal and Chemical Company, of Hartford, W. Va., is increasing its plant for making bromine and bromides. A new eight-inch well has just been sunk with most satisfactory results. Table salt, bromine products, calcium chloride and Epsom salts are manufactured. The bromine products are necessary in photography, pharmaceuticals and dyestuff manufacture, and are only manufactured at a few other places in America.

Lehn & Fink, Inc., New York, are building a large new plant at Bloomfield, N.J., to take care of the overflow from their present plant in Brooklyn. The new plant will comprise about nine buildings, and will be of most modern construction. This company has also purchased a site for a new large warehouse in the lower west side district in New York City. The Bloomfield factory will be located on both the Erie and Lackawanna Railroads.

The Monsanto Chemical Company, of St. Louis, has transformed its war-time phenol plant into a plant for the manufacture of chlorosulphonic acid. This product is manufactured by only two other concerns in the United States. It is extensively used in the manufacture of saccharine and other organic synthetic products. The Monsanto Company is also completing a large plant in East St. Louis for the manufacture of caustic soda and liquid chlorine.

The St. Louis Coke and Chemical Corporation are building a ten-million-dollar by-product coke plant in Illinois, near Granite City. The plant will be run in connection with the Granite City Steel Works, which will use much of the coke produced. The plant will use 2,000 tons of coal daily. The plant will cover over 500 acres and will embody many novel features of construction.

The United States Food Products Securities Corporation, which took over the interests of the Distillers' Securities Corporation, has acquired a number of sugar- and molasses-producing concerns with a view to producing industrial alcohol on a large scale. In addition to alcohol the company will manufacture and sell certain by-products of alcohol manufacture and cattle foods, molasses, etc. The company has also purchased a line of tank steamers, which will place it in a very strong position.

Last month a large portion of the chemical plant of Maas & Waldstein, at North Newark, N.J., on the Erie Railway, was destroyed by fire. The plant is situated in an angle between the railroad and the Passaic River, which added considerably to the difficulty of handling the fire, which was a very fierce one, owing to the kind of products manufactured in the plant. The damaged portions are being replaced, and the company is doing business as usual. They are manufacturers of solvents, lacquers, etc. During the war they operated two plants and made explosives for the French Government.

No German Dyes.

The War Trade Board has ruled definitely that no dyestuffs, intermediates or synthetic organic chemicals can be imported from Germany, Hungary or the portions of Russia dominated by the soviet government. Moreover, when the above substances are imported from other coun-

tries sufficient evidence will have to be provided to prove that they are not originally of German manufacture. This policy will probably last until sufficient information has been received by means of questionnaires to furnish a basis for the licensing system.

Alcohol Company Doubles Capital.

During the last month the United States Industrial Alcohol Company has announced a doubling of its capital, the capital stock being increased from $12,000,000 to $24,000,000. The common stock is being sold share for share to present stockholders at $70 per share. The new capital is for the development of numerous new products and processes, on which the technical staff of the compnay have been working for some time.

High Tariff on Glassware.

The bill providing for a high tariff on chemical glassware and laboratory apparatus has been passed by the House, and it is not expected to meet with opposition in the Senate. The bill provides for a duty of 60 per cent. on glass and porcelain laboratory ware and of 45 per cent. on optical glass and scientific instruments. No duty-free importation of these articles by the Government or by educational institutions is allowed.

Personal Items.

The vice-president of the National Lead Company, Mr. R. P. Rowe, accompanied by Mr. J. R. Wettstein, president of the United Lead Company, and Mr. E. McCarty, manager of the United Lead Company, have left for Europe to make a survey of the present business situation as affecting the lead and lead products business in England and on the continent.

Dr. Harold Hibbert, consulting chemist, of New York, formerly a resident of Toronto, is at present in London, England.

Mr. N. Owitz, formerly with the J. P. Devine Company, of Buffalo, builders of chemical machinery, is now located in New York with the Gordon Dryer Corporation.

Mr. Ellwood Hendrick, president of the Chemists' Club, New York, has returned from a trip to South America in the interests of Chemical and Metallurgical Engineering, of which journal he is a consulting editor. Mr. Hendrick has recently written a book called "Percolator Papers," an interesting volume of essays dealing with subjects more or less related to chemistry. The book is now published and is arousing much favorable comment.

WASTED WATER POWER.

It is estimated that between 30,000,000 and 40,000,000 of horse-power from unused watersources in the United States is flowing daily into the sea. The total amount of heat-produced power in the United States is 30,000,000 h.p.

COCOA PRODUCTION AND CONSUMPTION.

The total world's production of cocoa in 1917 was approximately 6,628,000 cwt.; of this amount the British Empire contributed 2,857,500 cwt.; Brazil, 1,194,361 cwt.; Ecuador, 800,000 cwt. The United States leads in consumption, using in 1918 about one-half of the world's supply. The value of this trade is about $40,000,000 per year. The Imperial Institute reports that in 1913 Germany was using about as much as the United States, taking 1,004,927 cwts. With a general opening of shipping it would seem that production must be stimulated, if excessive prices are not to restrict the demand.

HEVEA RUBBER.

In 1917 acreage in the Federated Malay States amounted to 1,044,839, with a total production of 82,319 tons. Tapping is becoming more conservative, and the single cut on one-quarter system is growing in favor. The problem of tapping is now complicated by bark diseases, and a generous application of antiseptics to tapping-cuts gives good results, if carried out soon enough. "Brown-Bast" is more serious, as it stops the flow of latex and causes burrs, as well as being hard to detect in early stages. The general question of manufacturing Hevea has not been thoroughly worked out, and the Agricultural Journal of India, 1919, found cases where regular mineral manures seemed to strengthen the growth of plants, but not to increase the yield. Lime gave encouraging results.

Continued experimental work has been carried on during the last year on the growth of trees, structure of bark, painting of renewing bark, tapping and the preparation of rubber. The elevation and total yearly rainfall are factors determining growth. In good soil, at 1,800 feet, the increase in girth will be 3¼ inches per year, and trees should be tappable at five years. At 2,800 feet the time would be eight years. A study of cortex of Hevea trees shows that trees giving good yields of latex have as many as thirty-four rows of laticiferous vessels in the soft portion of the cortex. A low ratio of hard cortex gives a higher yield. Painting renewing bark with coal-tar preservatives prevents "bleeding." According to Viries "Archief voor Rubber Cultuur in Nederlandsch-Indie," 1918, (p. 453), heavy tapping with two left-hand cuts on one-half or three-quarters of the tree will cause a very marked fall in the rubber content of the latex. Latex with 45% rubber at the beginning will fall to 7% at the end. Vulcanization shows that the tensile strength remains constant, but the time of cure decreased from 170 minutes to 105 at the end of tapping. The limit in the use of acetic acid as a coagulent where the acetic acid required to produce a clear serum is worth more than the rubber obtained accounts for a continual small loss in rubber. Viscosity is affected by nature of the coagulant, but there does not seem to be any clear connection between viscosity and tensile strength or rate of cure.

E. H. SARGENT TO EXPAND.

The well-known Chicago firm of E. H. Sargent & Company, manufacturers and importers in laboratory, chemical and bacteriological apparatus, whose announcement may be seen every month in the pages of The Canadian Chemical Journal, are making such expansions in their business as necessitates their removal from the premises they have occupied at 125 West Lake Street for the past 20 years, to the large, modern building located at the south-west corner of West Superior and St. Clair streets. Their new quarters consist of a six-story and basement building, erected about five years ago, of reinforced concrete, covering a ground area of 150 x 109 feet. The price paid by E. H. Sargent & Co. for their new headquarters is reported as $230,000, and was purchased from the American Merchants Syndicate. E. H. Sargent & Co. was founded 67 years ago, and the present officers of the company are: President, Thomas P. Smith, Jr.; Vice-President, G. Henbach; Secretary, F. J. Enright; Treasurer, F. P. Leonard.

RECENT INCORPORATIONS.

Plaster Rock, New Brunswick.—Fraser Pulp and Lumber Company, Limited. Capital, $5,000,000. Donald Fraser, Plaster Rock, N.B. To construct, operate paper, lumber and brick manufacturies.

St. Patrick of Rawdon, P.Q.—The Anglo-Canadian Malleable Steel Manufacturing Company, Limited. Capital, $50,000. Edmund Brossard, K.C., Montreal. To operate, make and sell all business relating to "Booth-Burn Furnaces," for the purpose of annealing by the Booth-Burn Malleable cast-steel process.

Montreal, Que.—The Anglo-American Wire Rope Company, Limited. Alexander Chase-Casgrain, K.C., Montreal. To mine, smelt and deal in ores, metals and minerals; to import, make and deal in wire; to manufacture and deal in chemicals. Capital, $200,000.

Montreal—King-Marceau, Ltd. Edmond N. Marceau, traveller, Montreal. To buy "The King Extract Co." To make and deal in essential oils, natural or synthetic products of flowers, etc. Capital, $50,000.

Toronto, Ont.—Canadian Luckenbach Processes Company, Limited. Frank H. Phippen, barrister, Toronto. To produce, deal in all processes, apparatus, devices, chemical agents or reagents, etc. Capital, $5,000,000.

Ottawa, Ont.—Capital Hide and Raw Fur Company, Limited. Jacob Kizell, Ottawa, Ont., merchant. To deal in hides and skins, to carry on tanning business. Capital, $40,000.

Bathurst, New Brunswick.—Eastern Produce and Fisheries, Limited. Azad Landry, merchant, Bathurst, N.B. To buy, sell, and deal in fish and to carry on general fishing business. Capital, $24,000.

Prescott, Ont.—Ontario Abrasive Wheels, Limited. Ara E. Kerr, town of Edwards, N.Y. Manufacture and deal in all kinds of abrasive wheels, stones, etc., composed either wholly or in part of carborundum, emery, etc. Capital, $30,000.

Sarnia, Ont.—Sarnia Cold Storage, Limited. Frederick R. Reeves, accountant, Sarnia, Ont. Refrigerating and cold Storage. Capital, $50,000.

Toronto.—Authors, Cox & Hanger, Limited. Thos. A. Rowan, barrister, Toronto, Ont. Chemists, druggists, manufacturers and dealers in medicinal and industrial chemicals, surgical appliances, etc. Capital, $200,000.

Ottawa, Ont.—Spardon Electrical Products Company, Limited. Richard J. Sims, barrister, Ottawa, Ont. Manufacture and deal in electrical and mechanical signal systems. Capital, $50,000.

Montreal, Que.—Mount Royal Rubber Company, Limited. Douglas L. McGibbon, merchant, Montreal. Manufacture and deal in rubber and products thereof. Capital, $500,000.

Montreal.—J. Cardinal, Limitee. Oliver Cardinal, merchant, Montreal, Que. Confectoners and manufacturers of foodstuffs of all kinds.

Montreal.—National Commercial Company, Limited. Ludger Martel, druggist, Quebec City, P.Q. To manufacture and deal in drugs, spices, chemicals, scientific apparatus, druggists' supplies, etc. Capital, $50,000.

Pointe-aux-Trembles, P.Q.—National Abattoirs, Limited. Louis Lapointe, M.P., Montreal, P.Q. To operate abattoirs and manufacture fertilizers, drugs, liniments, etc. Capital, $199,000.

Montreal.—Victor Manufacturing Company, Limited. John MacNaughton, barrister, Montreal. To manufacture and deal in chemicals, apparatus and products.

Granby, P.Q.—The Everlastic Corporation of Canada, Limited. Pierre E. Boivin, manufacturer, Granby, Que. To manufacture and deal in all kinds of rubber goods.

Toronto, Ont.—Allied Packers of Canada, Limited. William S. Morlock, barrister, Toronto. General packing and abattoir business, including fertilizers. Capital, $10,000,000.

Guelph, Ont.—Sterling Rubber Company, Limited. Manufacture and deal in all kinds of rubber goods, surgical and druggists' supplies. Frederick Le Freudeman, manufacturer, Guelph, Ont. Capital, $150,000.

Ottawa, Ont.—Andian National Corporation, Limited. Donald B. Sinclair, barrister, Toronto, Ont. To search for and recover petroleum, natural gas, oils, metals and minerals, manufacture and deal in chemicals, oils, etc. Capital, $1,000,000.

Montreal Que.—Roughton & Skelton, Limited. Louis P. Crepeau, K.C., Montreal. Jewellers, manufacturers and dealers in precious stones, etc.; miners and explorers for gold and mineral deposits. Capital, $15,000.

Montreal, Que.—United States Rubber Company of Canada, Limited. Errol M. McDougall, barrister, Montreal. Manufacturers and dealers in rubber, leather and felt, and by-products thereof. Capital, $20,000,000.

Toronto, Ont.—The Bayer Company. William A. J. Case, barrister, Toronto. Manufacture and deal in chemicals and pharmaceutical preparations. Capital, $20,000.

Montreal, Que.—J. R. Fournier, Limited. Joseph E. Fournier, manufacturer, Montreal, Que. General leather business, including leather goods of all kinds. Capital, $200,000.

Montreal, Que.—General Combustion Company of Canada, Limited. Milton L. Hersey, D.Sc., Montreal, Que. Manufacture and deal in combustion devices, furnaces, machinery used in melting or forging metals. Capital, $100,000.

Montreal, Que.—Pilot Steel and Tool Company, Limited. Arthur R. Holden, K.C., Montreal. To mine, manufacture, deal in metals, minerals, etc. Capital, $15,000.

Montreal, Que.—Gates Refractories, Limited. Gerald A. Coughlin, barrister, Montreal. Manufacturers and dealers in brick, terra cotta, tiles, stone, metals, minerals, ores and chemicals. Capital, $250,000.

Toronto, Ont.—Sterling Products, Limited. Manufacture, deal in chemicals and pharmaceutical preparations. William A. J. Case, barrister, Toronto. Capital, $20,000.

Montreal, Que.—Paint and Varnish, Limited. Manufacture, deal in paints, pigments, linseed oil, chemicals, varnishes, turpentine, alcohol, acetic acid, acetates, etc. Capital, $100,000.

Niagara Falls, Ont.—The Niagara Wire Weaving Company, Limited. Hamilton Lindsay, manufacturer, Cleveland, Ohio. Manufacture and deal in wire and wire cloth, etc. Capital, $220,000.

AUSTRALIAN COAL FOR PHILIPPINES.

The coal exporters of Australia are bidding strongly for the Philippine market. Their price is much lower than the Japan exporters, who have previously held this trade, having offered coal at $3.36 per ton, f.o.b. mines, while the Japanese quotation was $12.75 per ton, f.o.b. mines.

PROGRAM OF FIFTH NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, CHICAGO.

Monday, September 22nd, 1919.

12.00 m.—Opening of Exposition.

2.00 p.m.—Meeting American Institute Mining and Metallurgical Engineers at Congress Hotel.

8.00 p.m.—Opening addresses at Chemical Exposition Auditorium. Governor Frank O. Lowden, of Illinois, will make the address of welcome. Charles H. Herty, chairman of Advisory Committee, will respond. John W. O'Leary, president Metal Trades Association of Chicago, "The Relation of the Chemist to the Manufacturer."

9.00 p.m.—Motion pictures, in Chemical Exposition Auditorium.

Tuesday, September 23rd, 1919.

8.00 a.m.—Departure of members of the American Institute Mining and Metallurgical Engineers and American Electrochemical Society making excursion to steel mills at Gary, Indiana.

2.00 p.m.—Symposium on "America's Case in Chemistry," at Chemical Exposition Auditorium, with Ellwood Hendrick as chairman. Chairman's address by Ellwood Hendrick. "Dyestuffs," J. Merritt Matthews, editor, "Color Trade Journal." "Chemical Porcelain," Herman S. Coors, of Herold China and Pottery Co. "Laboratory Supplies and Blown Glassware," C. G. Fischer, of Scientific Materials Co. "Fine Chemicals," H. T. Clarke, of Eastman Kodak Co. "Glassware," "Optical Glass," Harvey N. Ott, of Spencer Lens Co., "Essential Metal Minerals" and "Pharmaceuticals," will be spoken of.

8.00 p.m.—Motion pictures in Chemical Exposition Auditorium. History and Utilization of Coal.

8.00 p.m.—Joint technical meeting of American Institute of Mining and Metallurgical Engineers and American Electrochemical Society at Congress Hotel.

Wednesday, September 24th, 1919.

10.00 a.m.—Meeting at Chemical Exposition of American Electrochemical Society for reading and discussion of papers: "The Effect of Amalgamation Upon the Single Potential of Aluminum," by Louis Kahlenberg and John A. Montgomery. "Depreciation in Small Dry Cells With Age," by A. J. Helfrecht. "Manganin," by A. Hunter and J. W. Bacon.

10.00 a.m.—Registration and meeting at Chemical Exposition of Technical Association of Pulp and Paper Industry in Officers' Room, First Regiment Armory. Address of welcome. Opening address by president. Report of Executive Committee. Report of secretary-treasurer. Reports by standing committees.

10.00 a.m.—Meeting at Chemical Exposition of American Ceramic Society.

12.30 p.m.—Adjournment for luncheon of all societies and for inspection of exhibits.

2.00 p.m.—Joint technical session American Electrochemical Society with American Institute Mining and Metallurgical Engineers at Chemical Exposition Auditorium. Subject: "Ferrous and Non-Ferrous Metallurgy." Among the papers to be presented are: "Electric Resistance Furnace of Large Capacity for Zinc Ores," by Charles H. Fulton; "Electrolytic Zinc," by C. A. Hauser; "Treating Antimony Ores," by George P. Hulst; "Water and Chlorides in Cement Copper," by Edward Keller; "Chemical and Electrochemical Problems Involved in the New Cornelia Company's Leaching Process," by Henry S. Mackay; "Radiant Resistor Furnace," by A. J. Fitzgerald; "Electric Heat in the Typewriter Industry," by A. M. Clark; "Electric Furnace for Experimental Work," by A. J. Fitzgerald. Many more papers are in the hands of the American Electrochemical Society Paper Committee for acceptance for these meetings. After the meeting is adjourned the electric furnace exhibits will receive careful inspection.

2.30 p.m.—Adjourned meeting at Chemical Exposition of American Ceramic Society resumed.

3.30 p.m.—Adjourned meeting at Chemical Exposition of Technical Association of Pulp and Paper Industry resumed.

6.30 p.m.—Dinner at Technical Association of Pulp and Paper Industry at Union League Club.

8.00 p.m.—Motion pictures in Chemical Exposition Auditorium. (1) "Resistance Type Furnaces for Melting Non-Ferrous Metals"; (2) "Electric Furnaces in the Heat Treatment of Essential War Materials" (both films by courtesy of Electric Furnace Co.); (3) "The Detroit Rocking Electric Furnace in Operation" (courtesy of Detroit Electric Furnace Co.); (4) "Shawinigan Power Development and the Shawinigan Industries" (courtesy of Shawinigan Water & Power Co.); (5) "The American Chemical Society Meeting, April, 1919, at the National Aniline and Chemical Co.'s plant, Buffalo, N.Y." (courtesy, Community Motion Picture Bureau); (6) "The Making of Cut Glass"; (7) "Manufacture of Glass."

Thursday, September 25th, 1919.

9.30 a.m.—Meeting at Chemical Exposition of Technical Association of Pulp and Paper Industry, general business meeting.

10.00 a.m.—Meeting of American Electrochemical Society jointly with American Institute of Mining and Metallurgical Engineers. Symposium on "Pyrometry" at Congress Hotel.

12.00 m.—Technical Association of Pulp and Paper Industry adjournment for luncheon at, and as guests of, Sears Roebuck & Co., to be followed by visit to the paper mill plant.

2.00 p.m.—Meeting at Chemical Exposition Auditorium. H. E. Howe, Division of Industrial Research, National Research Council, "The Organization and Plans of the National Research Council with Special Reference to the Industries." Price Green, Industrial Commissioner, Canadian National Railways, "Fields for Industrial Development, Canadian National Railways." Henry B. Faber, Industrial Filtration Corp., "Filtration." Thomas W. Pritchard, vice-president, Fuel Products Corp., "Destructive Distillation of Bituminous Material with Reduced Vapor Tension and Complete Temperature Control."

4.00 p.m.—Committee meetings Technical Association of Pulp and Paper Industry at Chemical Exposition.

6.00 p.m.—Motion pictures at Chemical Exposition. Jam Handy, vice-president Bray Studios, address during showing of first two films. (1) "Formation of Coal made Visible"; (2) "Chemistry of Gas Engines Made Visible."

8.00 p.m.—American Electrochemical Society Smoker at Congress Hotel.

8.30 p.m.—Technical Association of Pulp and Paper Industry smoker at Union League Club.

Friday, September 26th, 1919.

A.m.—Technical Association of Pulp and Paper Industry will visit Forest Products Laboratory at Madison, Wis.

9.30 a.m.—Meeting of American Electrochemical Society at Chemical Exposition Auditorium. Subject: Symposium on "Catalysis."

12.30 p.m.—Adjournment for luncheon.

2.00 p.m.—Meeting resumed on "Catalysis" by American Electrochemical Society.

8.00 p.m.—Motion pictures. Jam Handy, vice-president Bray Studios, address "Art Exposes the Invisible in Chemistry," during the showing of special films: (1) "Chemistry in Munitions"; (2) "Chemistry of Photography"; (3) "Invisible Chemistry of the Electric Battery"; (4) "Invisible Phases of Crystallation." (These by courtesy of Bray Studios). Price Green, Industrial Commissioner of Canadian National Railways, address: "Natural Resources on C.N. Railways." During address stereopticon and motion pictures will be shown.

8.00 p.m.—Award of Willard Gibbs Medal to W. A. Noyes, of University of Illinois, by Chicago Section of American Chemical Society.

Saturday, September 27th, 1919.

9.30 a.m.—Meeting at Chemical Exposition Headquarters of Technical Association of Pulp and Paper Industry for adjourned business session in Auditorium.

Afternoon—Technical Association of Pulp and Paper industry official visits of inspection to exhibits at Chemical Exposition.

2.00 p.m.—Meeting at Chemical Exposition Auditorium. Symposium on "Safety in Plant and Mine" under chairmanship of M. F. Leopold, safety engineer, U.S. Bureau of Mines.

8.00 p.m.—Motion pictures, depicting safety work in the plant and mine, by courtesy of U.S. Bureau of Mines.

During the week at the Chemical Exposition there will be shown upon the motion picture program the following films not already placed by definite dates on this program: (1) "Operation of Koppers' By-product Coke Plant," (courtesy The Koppers Co.); (2) "Continuous Motion Conveying, Stacking, Elevating, Loading and Unloading by Brown Portable Handling Machines," (courtesy Brown Portable Conveying Machinery Co.); (3) "The Manufacture of Zinc Oxide," (courtesy New Jersey Zinc Co.); (4) "The Making of Matches"; (5) "Gold Mining in Canada"; (6) "Building a Great Nitrate Industry at Muscle Shoals, Ala., by American Cyanamid Co."; (7) "Quarrying Canadian Asbestos"; (8) "Manufacturing Rubber Hose"; (9) "Making Lime"; (10) "The Silk Industry"; (11) "The Steel Industry"; (12) "The Iron Industry"; (13) "The Oil Industry"; (14) "Silver Mining in Bolivia." These are all recently completed films. Some now being made will be completed in time for the Exposition.

The registration badges of all society members meeting at the Exposition will admit them at the doors without other tickets.

THE BUOYANCY OF KAPOK.

The British Imperial Institute, after proper investigation, has shown that Indian Kapok may be used in the manufacture of life-saving appliances, life-buoys, etc. Until now Java Kapok has been the only variety used for this purpose.

The weights required to just sink bags containing four ounces of floss were, after 24 hours' complete immersion: Java Kapok, 83 ounces; Indian Kapok, 101 ounces.

WORLD'S BIGGEST TURBINE.

The largest steam turbine ever built, developing 100,000 horse-power, has been installed in a street railway powerhouse at New York City. At full load, the unit takes 826,000 pounds of steam an hour. All the elements, which in an emergency can be used independently, run at 1,500 revolutions per minute, driving twenty-five cycle three-phase generators of 20,000 kilowatts each at 11,000 volts. The three generators combined have a two-hour overload capacity of 70,000 kilowatts.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

The chemical market in Canada throughout the month of August did not exhibit any tendency to marked advances or depressions. Taken as a whole, trading was not perhaps as good as in July, at least this would seem to be the general opinion among chemical manufacturers, though some industrial concerns report good sales. There has been increased shipments from the United States of those chemicals which are regularly imported, due to the fact that the threatening tie-up of American railroads has caused the importers to get busy and order in advance. As to prices there has been hardly a change on the Canadian market worth noting. Copper sulphate has advanced a half cent per pound, due to the increased cost of copper, and zinc sulphate has dropped a half cent for opposite reasons on zinc.

Acids.—The trade in acids generally in the Canadian market has been steady throughout the month, no changes in price being noted. In the United States sulphuric acid, 60% and 66%, are in good demand, and the price is higher than for some months, the 60% averaging $12 per ton. This strong market for sulphuric is due to the demand of the fertilizer trade. The 66% sulphuric is selling at $18 a ton in the United States. At Buffalo, acid manufacturers report that they have difficulty in keeping up with the orders on both grades of sulphuric, and that there is a shortage of muriatic acid, with more inquiries than can be taken care of. On the Buffalo market prices on muriatic have advanced, the 20% grade now selling at $1.75 per 100-pound lots. At Toronto the muriatic has remained steady at from $2 to $2.85 per 100 pounds. On account of the large U.S. Government stocks that are being sold there is only a weak demand on nitric acid in the States, though latest wire reports seem to indicate that there is a strengthening feature developing that is helping to steady the nitric prices somewhat. The 40° Boume is selling at 10 and 10½ cents a pound, the 38° at 9 cents and the 42° at 11 cents in the Buffalo and St. Louis markets. At Toronto the 36° carboys are selling at from 8¾ to 9½ cents per pound.

American Cynamid Report.—Reduced net profits, despite the fact of a busy year and increased gross sales, is shown by the annual statement of the American Cyanamid Company, of Niagara Falls, Ont. Gross sales for the year ending June 30, 1919, amounted to $5,612,963, as compared with $5,587,076 last year. Total sales were $6,205,385, compared with $6,194,668 for 1918. A big increase in the cost of sales is noted for this year, the cost amounting to $4,518,704, as compared with $3,548,283 last year. Net profits on sales this year were $1,573,041, and in 1918 they were $2,345,235. Among the deductions noted is one for $61,356 loss on sale of Liberty Loan Bonds. Net profit for the year is $1,621,479, as compared with $2,435,360 last year.

METALS.

Iron and Steel.—The price of pig iron has advanced, and many of the plants have all that their furnaces can handle for the remainder of 1919. Companies do not appear to be anxious for orders for next year, and what orders have been made have been at an advance of from $1 to $2 a ton over present prices. Machine tool dealers and steel warehousemen find business at present satisfactory. At Toronto and Montreal machine tool purchasers are showing some delay, fearing the probabilities of labor troubles later on. Steel prices have remained at a level of about $5 per 100 pounds for the mild grade. Canadian plants are operating to-day at 75 per cent. of their capacity, and will not promise deliveries before the end of the year, so that no drop in prices may be looked for on considering these facts. Movements of ore on Lake Superior have been stopped due to dock strikes, and this, together with the prospect of higher railroad freights following the expected wage increases to railroad workers on American roads, has caused American producers of iron and steel to adopt a conservative selling policy. There was a large amount of ore on the docks at the opening of navigation, and blast furnace yards were unusually full of ore, so that a serious shortage of ore seems unlikely, even should the dock strike continue. It will be remembered that last month we spoke optimistically concerning steel orders for investment projects, but the labor developments of the past month have certainly made the outlook less favorable. The Steel Corporation of the United States in the spring of this year announced that they were opposed to any advances in steel prices, and the general opinion of the buying public against any advances in prices in any lines has backed up the Corporation's stand in this matter.

OILS.

Turpentine.—During the first week in September a drop occurred in turpentine prices. The drop is, however, only temporary. On September 2 the price at Toronto from the jobber was $2.50, on the 3rd, 4th and 5th it dropped gradually down ten cents, so that at the end of the week it was selling at $2.40. This break in the market was due to fear on the part of many dealers that the United States Congress would not ratify the Peace Treaty, and that therefore American interests could not finance German buyers. Germany was counted on as the heaviest buyer from Europe, as she always was before the war, and being in great need of turpentine now, large shipments were made, ready for her to be shipped during September. We learn from reliable sources in the South that large quantities of turpentine are piled high on Southern docks, which it will be impossible to move until the Treaty has been signed. This is, of course, fully expected, and, just as soon as movements get going regularly to Europe the price will advance, and it will not be long before it reaches the $1.77 per gallon mark at Savannah, as it did on August 4th last.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	.90
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.04½—.05½
Acetic acid, refined	Lb.	.20½—.21½
Acetone	Lb.	.18½—.23½
Aspirin, in 100-lb. lots	Lb.	1.20—1.35
Alcohol, pure, bbl., 65% O.P.	Gal.	8.25
Alcohol, methylated, bbl.	Gal.	2.00
Alcohol, wood, 95%, refined, bbl.	Gal.	2.00—2.20
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminum Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.09—.12
Ammonium Carbonate	Lb.	.10
Ammonium Chloride	Lb.	.15—.20
Benzoic Acid	Lb.	1.30

Bleaching Powder, 35% drums	100 Lbs.	3.25—3.50
Borax, crystals	Lb.	.09—.09½
Boric Acid, powdered	Lb.	.16—.16½
Calcium Carbide, in carload lots	per Ton	—85.00
Calcium Carbide, per single ton	per Ton	—90.00
Calcium Carbide, less than ton lots		—96.00
Calcium Chloride, fused	per Ton	$25—$30
Carbolic Acid, white crystals	Lb.	.20—.21
Carbon tetrachloride, drums	Lb.	.20—.24
Caustic Soda, ground, bbl.	Lb.	.04¾—.05¼
Chloroform	Lb.	.40—.58
China Clay, imported	per Ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.20—1.30
Cobalt Oxide, black	Lb.	1.65—1.90
Copper Sulphate (Blue Vitriol)	Lb.	.10—.10½
Formic Acid, 75%	Lb.	.40—.42
Fuller's Earth, powdered	100 Lbs.	2.00—2.50
Glycerine, drum, C. P.	Lb.	.24½
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16—.18
Magnesite, calcined	per Ton	—25.00
Magnesite, clinkered	per Ton	—35.00
Magnesite, raw	per Ton	—10.00
Magnesium Carbonate, bbl.	Lb.	.18—.22
Magnesium Sulphate	Lb.	.03¼—.04
Muriatic Acid, 18 to 22	100 Lb.	2.00—2.85
Naphthaline, flake	Lb.	.10—.11
Nitric Acid, 36 carboys	100 Lbs.	.08¾—.09½
Oxalic Acid	Lb.	.35—.37
Oleic Acid	Lb.	—.23
Potassium Bicarbonate	Lb.	—.41
Potassium Bromide	Lb.	—.72
Potassium Hydroxide (Caustic Potash), 100 to 500 Lb. lots		—.40
Potassium Hydroxide (Caustic Potash), 25 to 100 Lb. lots		—.42
Potassium Hydroxide (Caustic Potash)	in sticks	—1.50
Potassium Nitrate, kegs	Lb.	.22—.24
Potassium Permanganate, bulk	Lb.	1.50—1.75
Phenacetin	Lb.	3.10—3.25
Salicylic Acid	Lb.	.45—.60
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.14—.16
Sodium Cyanide, bulk, 98-99% in cases	Lb	.34—.35
Sodium Nitrate, refined	100 Lbs.	6.75—7.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.00—5.50
Sodium Benzoate	Lb.	1.10—1.20
Sodium Bicarbonate, 100% pure	100 Lbs.	3.50—4.00
Sodium Bichromate, bbls.	Lb.	.19—.20
Sodium Nitrite	Lb.	.15—.16
Sodium Hyposulphite, kegs	100 Lbs.	—4.15
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	2.50—2.75
Sulphur, roll	100 Lbs.	4.00—4.25
Sulphuruic Acid, 66 Be, carboys	100 Lbs.	2.50—2.70
Sumac, extract liquid, dark	Lb.	—.08
Sumac, extract liquid, colorless	Lb.	—.17½
Sumac, powdered	Lb.	.31—.35
Sumac, extract, No. 2	Lb.	—.10½
Sodium Bisulphite, 35	Lb.	—.02½
Tannic Acid, commercial	Lb.	.85—1.00
Tartaric Acid, crystals or powdered	Lb.	.95—1.05
Tin Chloride, crystals	Lb.	—.10
Zinc Sulphate, com.	Lb.	—.05½
Zinc Dust	Lb.	.17—.19

Metals

Aluminum, No. 1, 98-99%	Lb.	.44—.46
Antimony	Lb.	.10
Brass, yellow ingots	Lb.	.15—.19
Brass, red	Lb.	.21
Cobalt, metal	Lb	—2 50
Cobalt Oxide, grey	Lb.	—1.75
Copper, casting	Lb.	—.25
Copper, electrolytic	Lb.	—.26
Copper, electrolytic, in car lots	Lb.	.25
Iron, common, base price	100 Lbs.	—5.00
Lead	Lb.	—.07½
Lead, in car lots	Lb.	.06
Magnesium	Lb.	1.75—2.25
Mercury	Per 75-lb. flask	$125
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure, Government price	Oz.	—105.00
Silver, bar (U.S. Govt. price)	Per troy Oz.	—1.12
Spelter	Lb.	.10
Spelter, in car lots	Lb.	.08
Steel, mild	100 Lbs.	—5 00
Steel, nickel, in bars, 3½% nickel	Lb.	.18—.20
Steel, sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	—.60
Zinc, sheets	Lb.	.18—.10

Oils and Coal Tar Products

Motor Gasoline	Gal.	—.32
Motor Gasline (service stations)	Gal.	—.35
Lighting Gasoline	Gal.	—.37
Naphtha	Gal.	—.31
Coal Oil	Gal.	—.20½
Fuel Oil	Gal.	—7.00
Mid. Continent Crude (42 W. gal.)	Bbl.	—2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	—4.00
Crude Creosote Oil	Bbl.	16.00—18 00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	—7.25
Refined Coal Tar	Bbl.	—8.50
Coal Tar Pitch, in bbls.	Ton	—24.00
Benzol, Pure	24 to 28c	per gallon
Refined Solvent Naphtha	20 to 25c	per gallon
Pure Toluol	25 to 30c	per gallon
Dip Oil, 20 per cent.	38 to 46c	per gallon
Crude Carbolic Acid, 25 per cent.	40 to 45c	per gallon
Naphthalin Flake	.08½ to .09½c	per pound
Naphthalin Balls	10½ to 11½c	per pound
Alpha-Naphthylamin	45 to 50c	per pound

Flotation Oils and Naval Stores

Spirits of Turpentine, in bbl. lots (Imperial), gal.	—2.40
Rosin, Grade G, in 280 bbl. lots	28.00
Rosin, Grade W.W., in 280 bbl lots	33.00

Vegetable Oils

Anise Oil, Lb.	—2.00
Castor Oil, (Medicinal), in bbl. lots	.35 lb.
Castor Oil, (Commercial), in bbl. lots	.30—.32 lb.
Cocoanut Oil, (Refined)	.26 lb.
Linseed Oil, raw, in bbl. lots, (Imperial), gal.	3.25
Linseed Oil, boiled, in bbl. lots (Imperial), gal.	3.28

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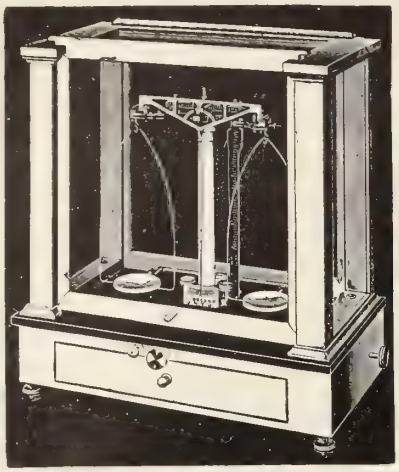

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Certificate of Analysis

I, J. A. Dawson, Public Analyst, attached to the staff of the Department of Trade and Commerce, Vancouver, B.C., and acting under the authority of the Adulteration Act, do hereby certify:

(1) That I received from G. C. Crux, of Vancouver, B.C., on the 11th day of August, 1919, a Sample labelled as follows: "Sample of Epsom Salts, from Basque Chemical Production Co., Limited, 509 Richards St., Vancouver, B.C. General average sample of shipment to be made Aug. 12, 1919."

(2) That I duly analysed the said sample and obtained the following results:

Water by loss on ignition	49.12% wt.
Magnesium as Mg	10.29% wt.
Sulphate as SO_4	40.62% wt.
Sodium as Na	0.08% wt.
Silicate as SiO_2	0.01% wt.
Total	100.12% wt.

ARSENIC, LEAD, ALUMINUM, IRON, ZINC, CALCIUM, CARBONATE, PHOSPHATE AND NITRATE. ..... ABSENT.

(3) That the said Sample was:

(a) Of B.P. or U.S.P. purity within the meaning of the Adulteration Act (Section 7); for the following reasons:

It contains not less than 97.4 per cent. of pure Magnesium Sulphate, Mg SO_4, $7H_2O$ (B.P.), also not less than 99.7 per cent., pure Salt (U.S.P.). It is free from arsenic, lead, iron, zinc and chlorides.

(Signed) J. A. DAWSON,
Public Analyst.

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The Dominion Government, realizing the close relation which exists between water power and chemical industry, has secured a booth on the main floor of the Coliseum, where the Fifth National Exposition of Chemical Industries will be held in Chicago during the week of September 22nd.

At this Exposition will be concentrated the principal exponents of chemical engineering on this Continent, and it therefore affords a great opportunity of demonstrating what Canada has to offer as a field for chemical industry.

The booth secured by the Department of the Interior of the Dominion Government will be fitted up as an information bureau for Canadian water powers and will be placed in charge of an engineer of the Dominion Water Power Branch staff, qualified to answer any inquiries concerning the water powers of the Dominion.

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Lot 4—26 6-Gallon Earthenware Crocks.
Lot 5—Six 15 to 50-Gallon Earthenware Crocks.
Lot 6—3 Ventilating Staffs.
Lot 7—5 Pumps.
Lot 9—2 Galvanized Iron, 3 Steel Tanks.
Lot 10—2 Wheel Trucks. Wheelbarrow.
Lot 11—2 Wooden Tables and Trough.
Lot 12—Wooden Vat with Lead Coils.
Lot 13—1 Lot of Chemical Sundries.
Lot 14—Electric Starter for Motor.
Lot 15—21 Glass Chemical Flasks.
Lot 16—14 Chemical Stoneware.
Lot 17—Duriron Kettle with Jacket.
Lot 20—1 Suction Fan, 24 inches.
Lot 21—4 Chemical Stoneware Crocks, 50-Gallon.
Lot 22—Elyria Enamelled Pans, One 20-Gal. Kettle.
Lot 23—3 Drying Cabinets.
Lot 24—4 Crocks, special design.
Lot 25—Chemical Stoneware.
Lot 27—25 Enamelled Pans, 12″ x 20″ x 2″ deep.
Lot 28—Chemical Stoneware Pipes.

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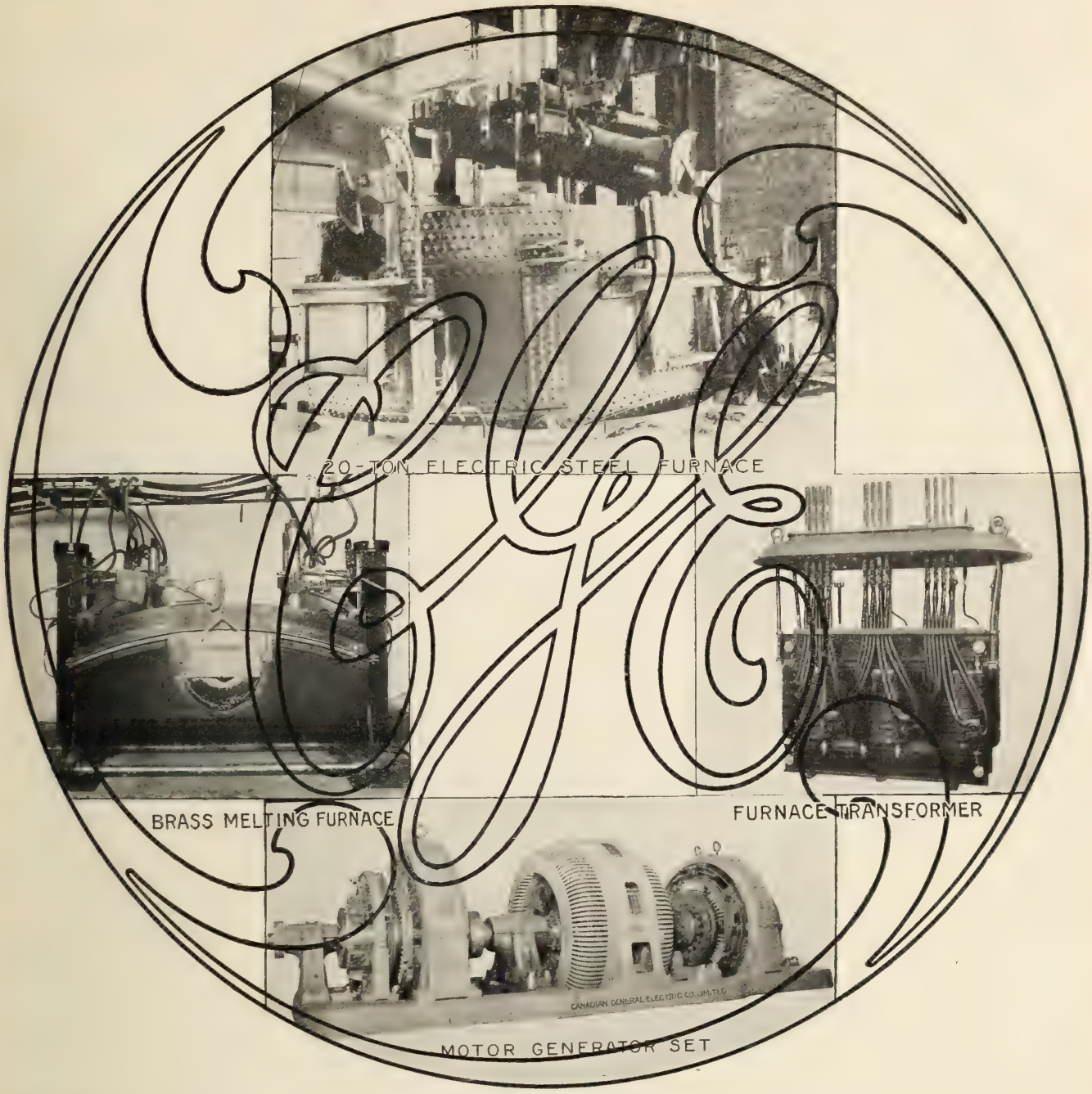

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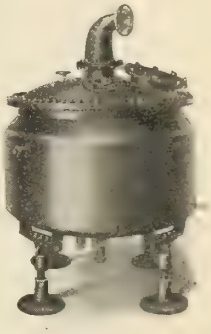

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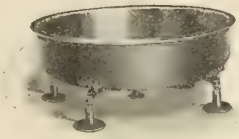

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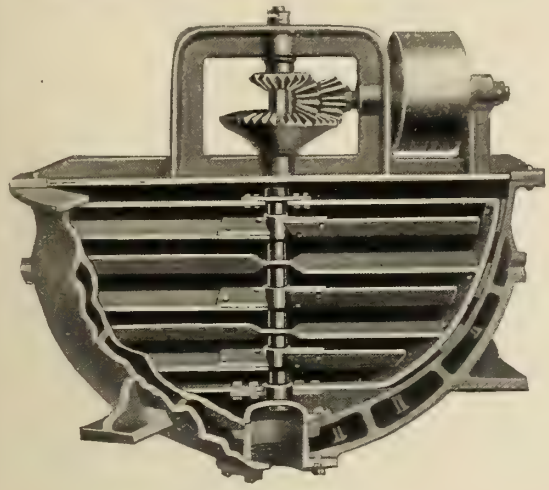

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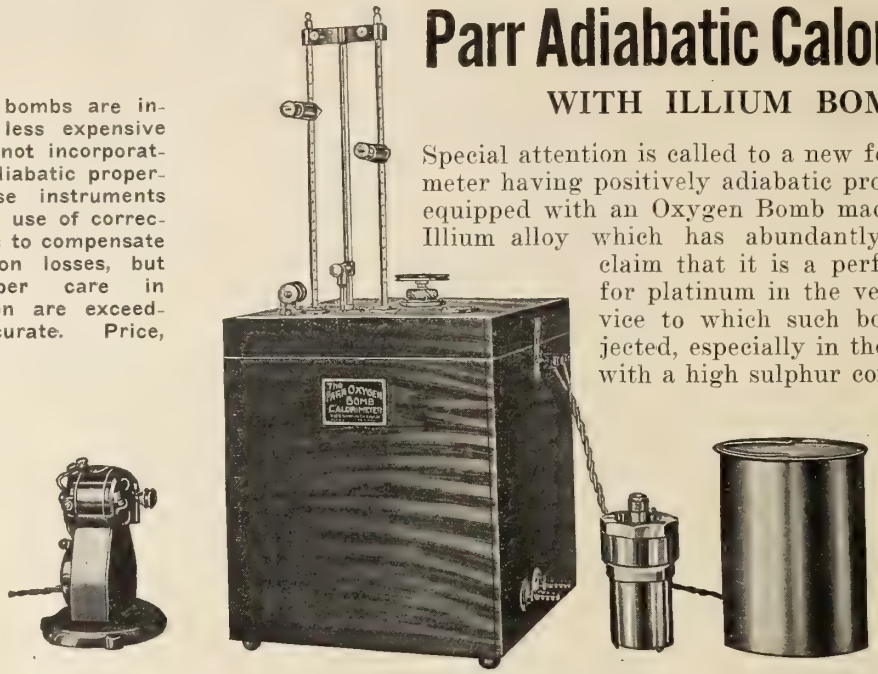

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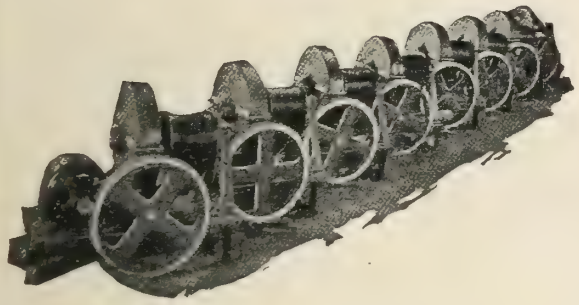

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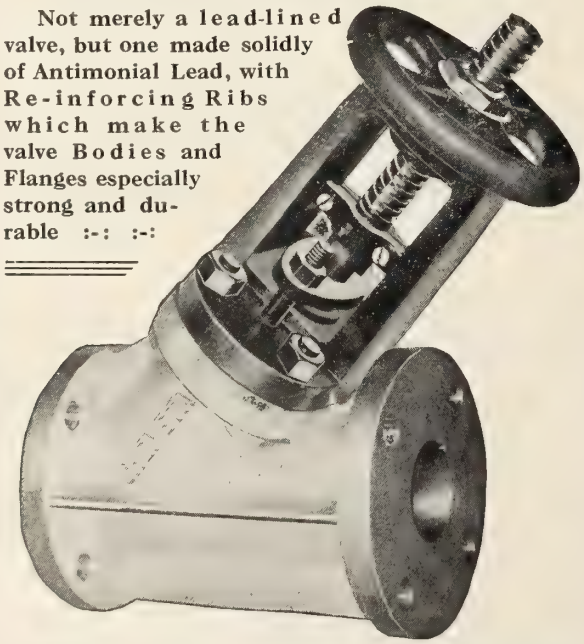

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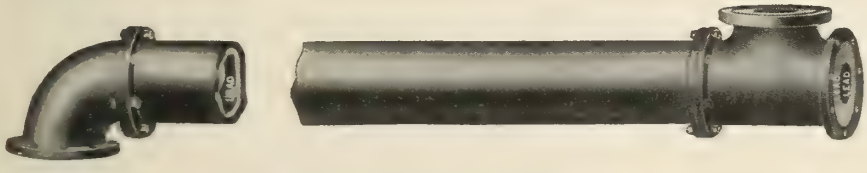

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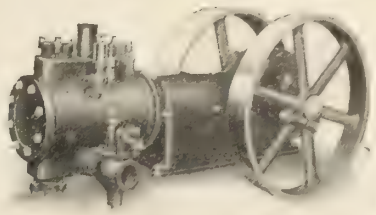

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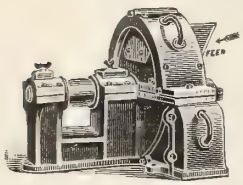

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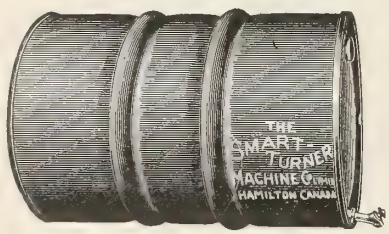

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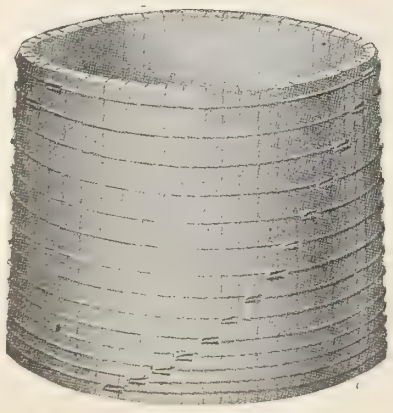

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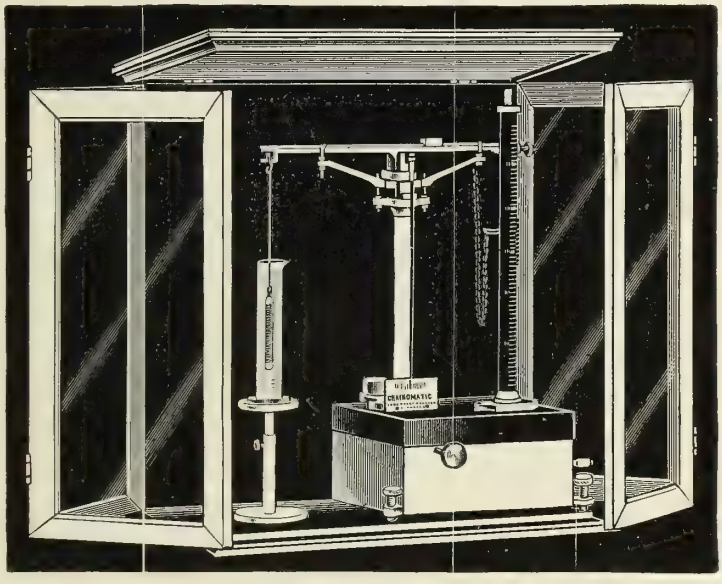

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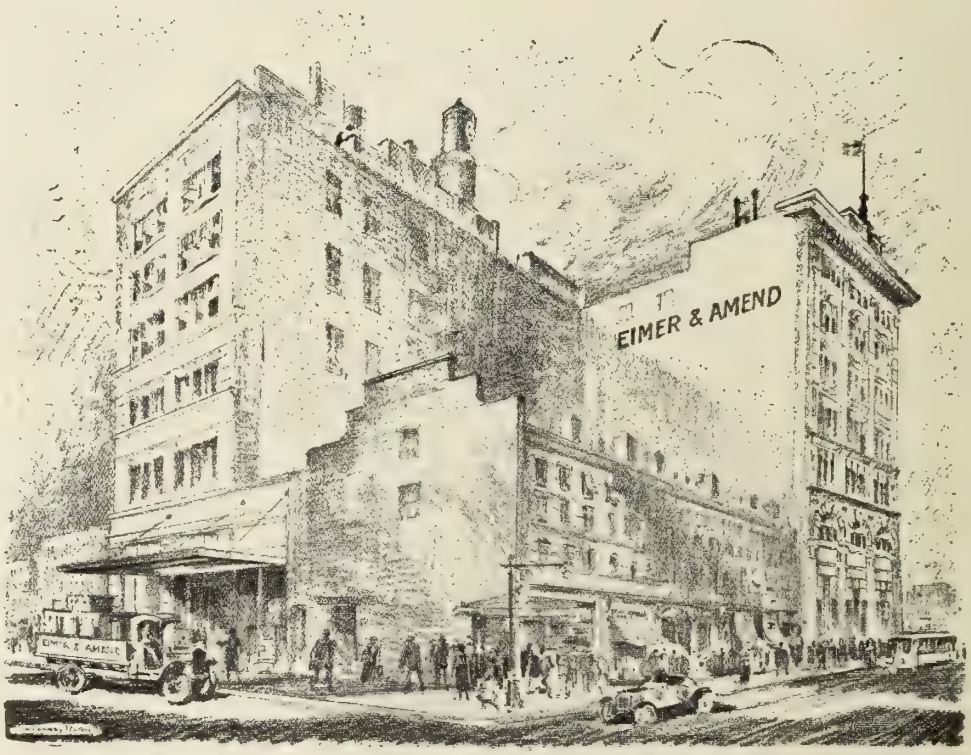

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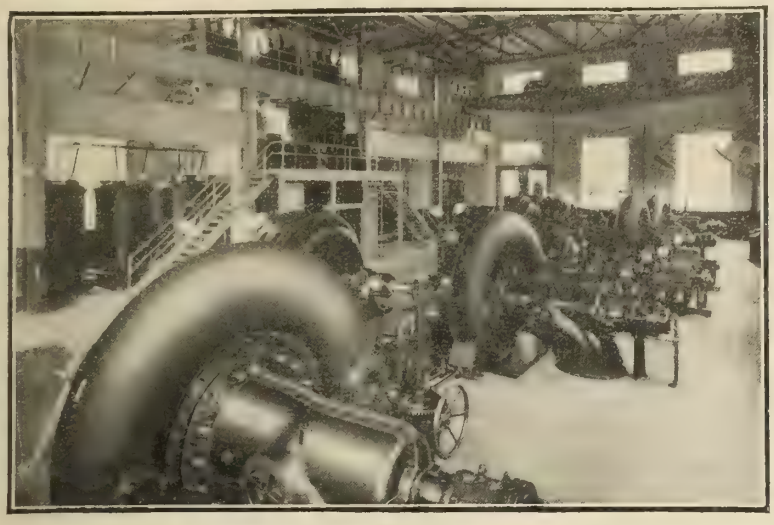

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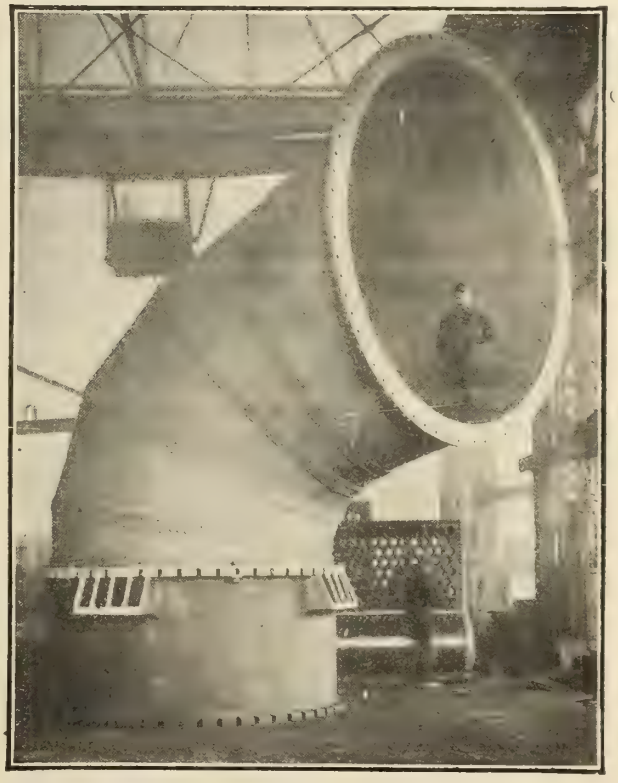

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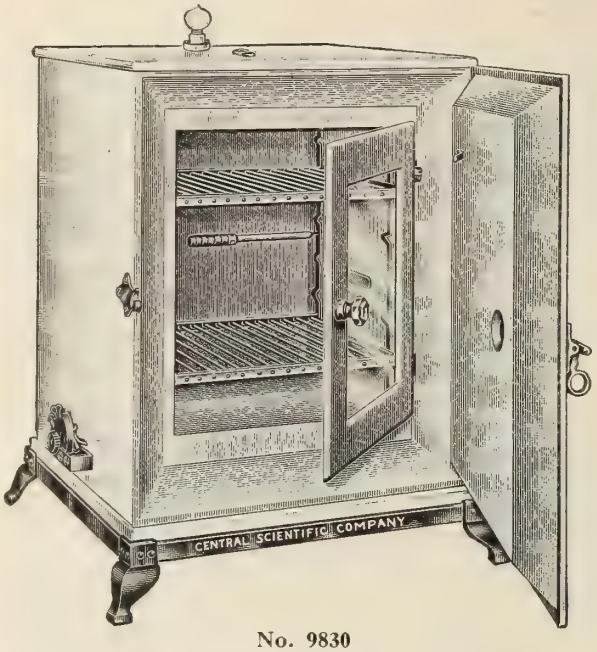

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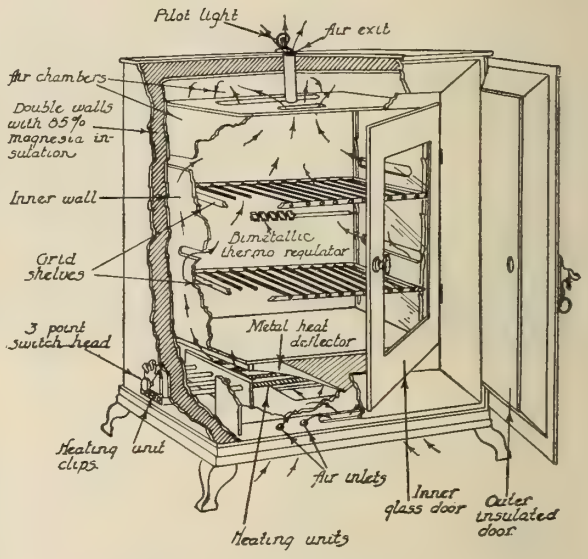

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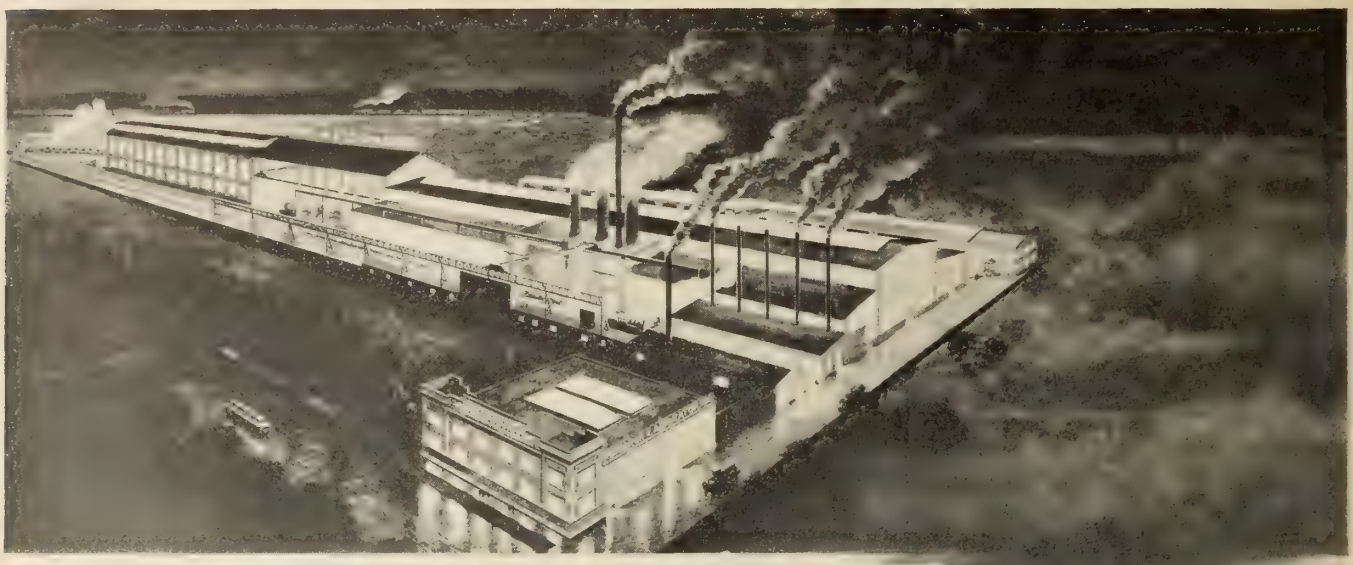

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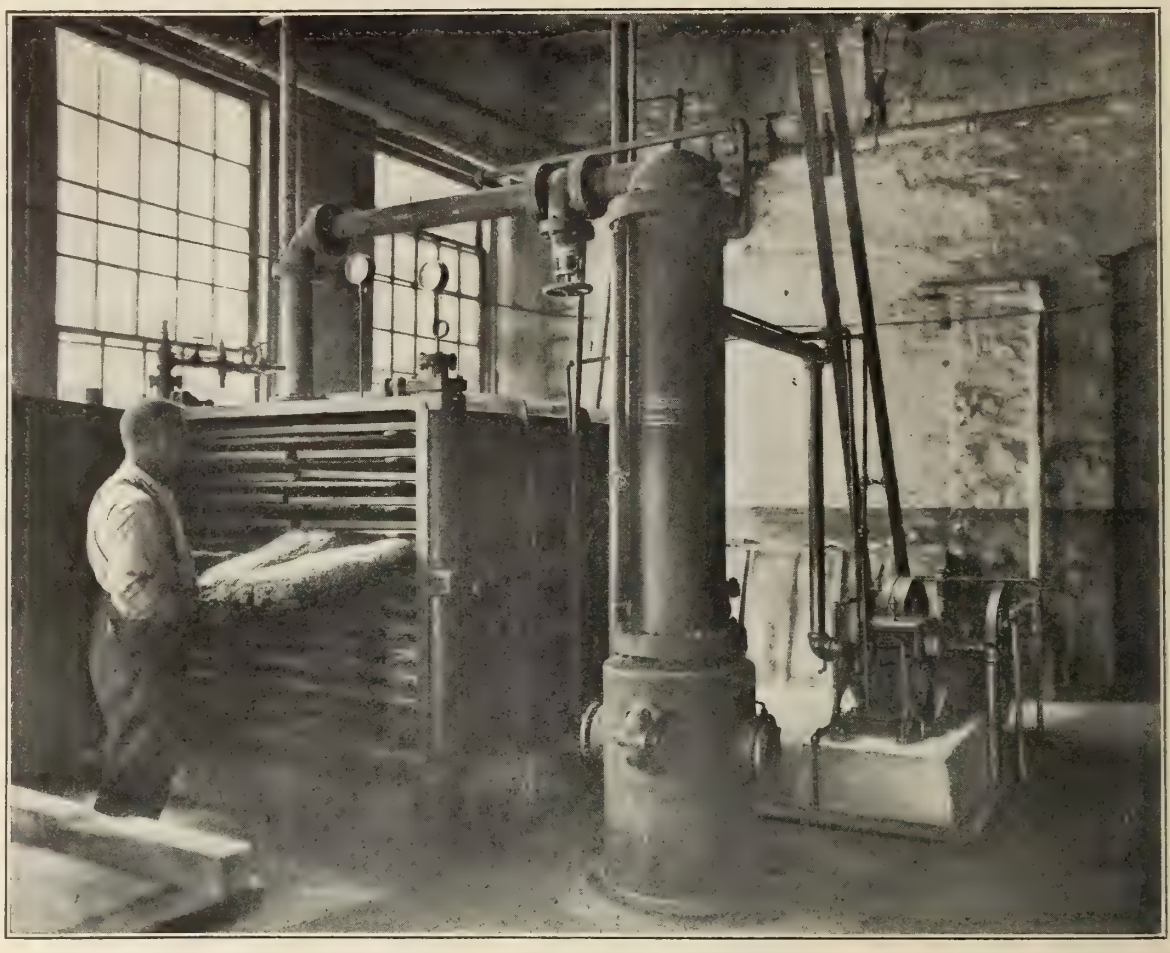

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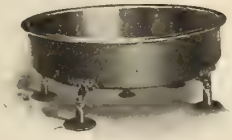

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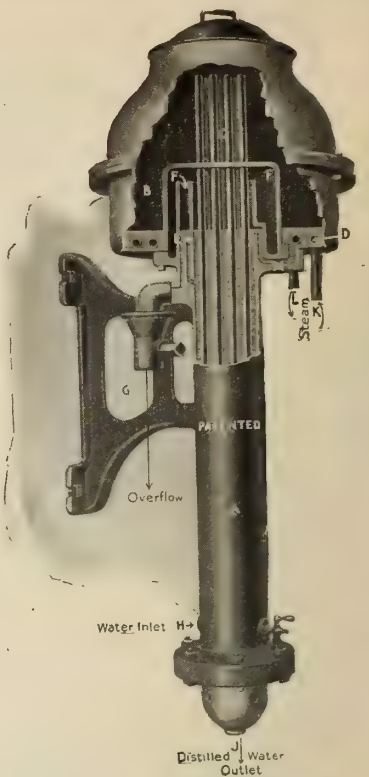

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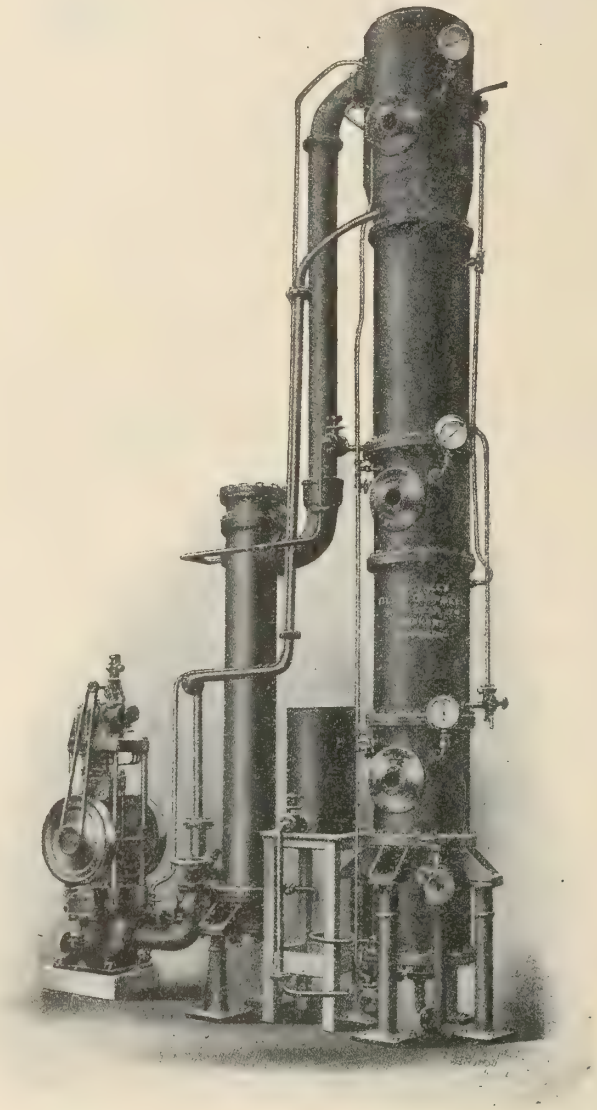

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Forests: Pulpwoods in abundance afford the raw material for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically all minerals, with the exception of coal and tin, are found in the premier mineral Province of Canada. Statistics of output, as compiled by the Ontario Bureau of Mines, show a valuation of $80,308,972. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:

Silver	$185,027,590	Nickel	$138,010,542
Copper	49,947,080	Pig Iron	78,925,917
Gold	50,864,863	Cobalt	5,918,899

Non-metallic products include actinolite, arsenic, barite, cement, clay and shale for ceramic industries, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, lime, mica, mineral waters, natural gas, petroleum, quartz, salt, sand and gravel, stone for all purposes, and talc.

Industrial Opportunities: Midway between West and East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities, both by rail and water, are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Developed hydro-electric power is available at very low rates from the Hydro-Electric Power Commission of Ontario. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula.

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THE OFFICIAL JOURNAL OF THE CANADIAN INSTITUTE OF CHEMISTRY

Vol. 3 TORONTO, OCTOBER, 1919 No. 10

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Address all communications to The Canadian Chemical Journal, 72 Queen Street West, Toronto, Canada. Telephone, Main 7399.

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Become acquainted (if you are not already), by reading this sketch, with the secretary of the Canadian Institute of Chemistry.

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EDITORIALS

A WEEK AT CHICAGO.

WITH the closing of the Chemical Exposition held at Chicago the most important event of the month and the year, as far as chemistry in America is concerned, has just passed.

Much modern wisdom can be gained only by travel, and undoubtedly it was well to first focus the attention of the chemical industries of America on the Chicago district, and then, from that point, look out upon the field from its very centre. Chicago is not familiar with chemical expositions, and it may be said that there was less popular acclaim by the press than might have been displayed elsewhere. At the same time the solidity of interest shown by the many organizations and industrial plants surrounding the district is evidence of the growth and progress under development.

In resources the States adjoining have been particularly enriched, and their power to sustain a heavy population has allowed a mass of essential industries to congregate, which, in turn, has made the city a great chemical centre. Wisconsin, Illinois, Indiana and Michigan have constantly poured business toward this city, and now their resources may be utilized to full measure by the industrial chemical organizations within this circle.

No more advantageous position could be possible in the United States for carrying on business with the whole of the Dominion of Canada. Both eastern and western industrial centres are about equally distant. During the whole of the period of growth which must follow the introduction of population and capital into the Dominion, special industries in the United States will continue to find a substantial market for their products, and by location Chicago is well qualified to succeed in this trade.

It was strikingly evident that the Chemical Exposition is drawing harder year by year on the chemists of America and on business men associated with a variety of industries. They certainly come to see and investigate. While there is a keen pleasure shown in their hearty welcome to friends, there is also a genuine seeking for new and better methods, machinery and business connections. This will tend in time to make the Exposition a concentrated clearing-house of chemical business for America.

Already it is utterly impossible to follow with ease more than a fraction of the program. It is perhaps unfortunate that there is no way in which members of various organizations can hold more joint gatherings. Even the titles of papers presented become as much as an individual cares to read. A narrowness is developed which may be the best for some, but is hardly what the average man requires at the moment. Neither the magnitude of chemical industries, nor the spirit of the occasion, is reached by meetings of separate societies, even though they do grapple for the moment with the most important general, practical or theoretical problem of the industry. A week is such a short time after all, and even when the most carefully selected portions of the program have been followed, there is a feeling of many good things missed.

To the business man the Exposition is a most marvellous series of visions. Fundamental machinery and processes are so well shown and so ably demonstrated that, perhaps for the first time, he may get something like a grasp of the direct application of chemistry to modern human life.

Undoubtedly capital is attracted to such an exposition because an increased premium is being placed on the method of industrial progress exemplified by the displays gathered together. Something that whirls around like a toy and bubbles air through a liquid may, when translated, revolutionize an industry. The products and machinery shown are so important to a multitude of industries that every occasion for their demonstration is eagerly grasped. In all this our recent world-conflict has created a new interest in America. Ideas are being turned into dollars before the eye in a most inspiring manner, and, more important than this, a feeling is taken away that any nation must essentially advance if these forces here in evidence are joined to the right type of social national life. With sane relationships existing between men and nations, chemical expositions give hope of a great future.

OUR UNIVERSITY PROBLEMS.

EVERY year, with October, Canadian universities are face to face with the tremendous task of preparing for the various professions and the business world more students than they are really equipped to handle. University teachers, university men and university funds and buildings in this Dominion have the proudest record to maintain. The most was expected of them, and they bettered expectations in the war. Now they are again faced with their more normal problems, but with

the changed conditions they seem less able to fully meet the situation.

Every one is demanding modifications in the training of practically all our citizens. We have people who would forcibly remould foreigners as they come to our shores, in order that they may not injure our industrial machinery and to the end that they may see as we see and live as we live. Demands are increasing for a kind of modified agriculture that will include every boy and girl born on the farm to the end that they may enjoy life better and raise more thoroughbred chickens on some other farm instead of rushing to large centres. These would increase our agricultural schools by about one hundred per cent.

There are corresponding interests stirring on behalf of technical education for industrial workers. In a general way our directors of industry feel that perhaps it would be wise to perfect the human machinery they employ a little more, in the hope that progressive ideas may be stimulated and a greater measure of efficiency obtained. There is also the consideration that more mentally alert workmen might be happier. In any event, a quickening of the pace could not help but be beneficial. It has thus come about that gatherings of business men at trade conventions pay a great deal of attention to what is called technical education, and many resolutions are passed. We all wish the forces stirring these pots every success, but until a more genuine heartfelt worry is shown about the minds of these unskilled workmen and less attention given to the direct personal benefits which seem so obvious over banquet tables, we question seriously whether the patients about to be subjected to these various schemes will respond to the operation. Brooding over the whole field we have the Honorary Advisory Council for Scientific and Industrial Research. All these agencies have behind them capital in some direct manner. They have some chance to say to men of industrial affairs that if they will club together and put up only a few dollars, fabulous returns on the investment are assured. It all sounds so direct and businesslike and is so in accord with up-to-date methods that the appeal can hardly be resisted. We thus find expenditures of a few thousand dollars proposed by industries that are sapping, at a most profitable rate, some of our leading national resources.

No one seems to really know where the universities are to be placed in this system. It is not easy for them to obtain funds from the Dominion Government. They are utterly unable to really impress provincial authorities, and we find institutions that have made possible these industries now so much alarmed about technical education and research, on the very streets begging for funds or hoping that some one will remember them in their will. Our utterly foolish methods of attempting educational business on a charity basis are seen here in true perspective. On the shoulders of our universities rests the entire burden of training men and women for the finer things of life, as well as preparing for the State those who must necessarily, in a great measure, help to guide affairs in every field of endeavor. The dream of a university education for all those mentally (not financially) able to take the work should become a reality. When one thinks of loyalty one should place first the members of our university staffs. All down the lines teachers are feeling the pinch of poverty, but for definite cases of underpaid services we point out the modern example of university teachers.

Because these men are too gentlemanly to go on strike and too noble to desert their life-work, they continue to carry on doing what they can for the very industries and the very research work that soon forgets them. While we need expenditure along many lines, and while industries should possess and demand technical schools, and while the Dominion Government should lead in organization work and the foundation of industrial research institutions, some one should come forward who is big enough to nationalize and expand our universities by pumping financial blood into their veins, right now when they can, according to their opportunity, do so much or so little for the rising generation of Canadians.

INDUSTRIAL CANADA AND WATER-POWER DEVELOPMENTS.

LOOKING back over the comparatively short period in the life of a nation of twenty-five years one cannot but be impressed with the fact that Canadian progress has been largely due to her development of water-power resources.. As cities grow their demand for the amenities of life develops an ever-increasing demand for power—electric light, transportation and other public utility requirements multiply while industries spring up steadily increasing the power load. Again, in certain cases the existence of a water-power site has decided the location of some industry, and a large and prosperous community has sprung up entirely due to the location of this hydro-power.

Montreal, Toronto and Winnipeg, the three largest cities in the Dominion, draw practically all their power requirements from hydro-electric sources, as do the great majority of the remaining cities and towns.

The extent to which water-power enters into the

ordinary life of Canadians is strikingly illustrated by the figures given in the Census of Central Electric Stations, taken by the Dominion Water-Power Branch in co-operation with the Dominion Bureau of Statistics. This census shows that over 1,700,000 horse-power was derived from water power, while steam provided barely 180,000 horse-power, and other sources under 12,000 horse-power. It is also shown that the Provinces of Quebec, Ontario and Manitoba obtain 95% of their central station power from water, while British Columbia obtains 90% from the same source.

The above figures refer to central station development only, the total water power developed in Canada is now over 2,300,000 horse-power, nearly half a million of which (including that supplied from central stations) is used in the pulp and paper industries, while nearly a quarter of a million horse-power is exclusively developed for industrial purposes—milling, mining and electro-chemical processes.

The average development of water power throughout Canada amounts to 276 horse-power per 1,000 population, and saves anywhere from twelve to fifty million tons of coal annually, according to the efficiency allowed for in making the comparison. Norway alone of the countries of the world exceeds Canada in per capita water-power development.

Great as is the present use of water power in Canada, the power developed represents but a small proportion of the available supplies. Estimates vary, but conservative official figures, neglecting resources at present remote from civilization, place the grand total of the water-power supply at from 18 to 20 millions horse-power, much of which lies adjacent to large industrial centres and is being steadily developed as the demand requires. This demand is growing with increasing rapidity owing to the development of new electro-chemical and electro-metallurgical processes, and growth will be still further accelerated as the increasing cost of fuel causes railways and manufacturers to substitute hydro for fuel power wherever possible to do so.

A PROGRAM FOR CHEMICAL SOCIETIES.

THERE are many chemists in Canada who do not cultivate their social chemical instincts sufficiently. They are of the school who believe that they made a big mistake when they entered the profession they are in, and that this unhappy choice, made some time ago, leaves nothing but a plodding existence ahead of them.

The average chemist is not proud. This modesty has, to a certain extent, ruined his usefulness. He will remain silent at times when anyone else would be pounding home the idea that he was an important individual in a class that, as a whole, stood at the very top of all professions. This is one of the causes of poor salaries, and the simple-minded ignorance displayed when men, otherwise well informed, begin talking about things chemical.

The general object of any chemical society should be not only to give members an opportunity to learn something from the work and experience of all their fellows, but to also carry on a publicity campaign that will force thought on the part of business men along lines of work in which chemists are of great importance. Every day we read in papers, boasting their great age and wide circulation, that some fire was started by an "acid" which fell on the floor and in a few minutes was put out by a "chemical" hastily brought in by the local fire department.

We are entering upon a new series of meetings about to be held by the Society of Chemical Industry and other chemical societies in various parts of the Dominion. There are many chemists who cannot attend sectional meetings because of distance, but there still remain many who are a real drag to their profession because of their lack of interest in those things which would assist a larger development of public appreciation. No matter what variety of chemist you may conceive yourself to be, you are needed by these organizations which are doing all they can to insert the fundamental principles of chemistry into business and ordinary industry at points where they can be of most benefit.

The success of a meeting is not measured by the number of chemists present, but rather by the number of other professions and business men who have been found willing to mix in this way. It is obvious, then, that the best meetings are not those which are the most technical but rather those that have a general appeal with a chemical flavor. The essential idea is the creation of the chemical point of view in the minds of a larger number. Broaden the significance of the word chemistry in the minds of all classes of manufacturers and technical men. These things count in measuring the grip and progress that chemistry has or is making.

There is a place for the technical group of experts. They, too, should meet and have their special speakers, but at those larger gatherings a great opportunity is missed if the type of mind present remains too confined. Chemists must remember that they belong to a new profession and one which is so general that it is difficult to define their field. Make yourself as broad as you will, but if you have been trained properly you will still be a chemist. The world of industry and the cause of research needs the chemical point of view, and you are the only missionaries we have.

The Action of Dilute Sulphuric Acid Solutions Upon the Tensile Strength of Cotton Yarn.

By WALTER A. LAWRANCE

THE hydrolytic action of some inorganic acids upon cotton fibres, which are, of course, essentially cellulose, has been known for many years. In 1881, Girard* published an account of his investigation on the hydrolysis of cellulose with sulphuric acid, in which he states that hydrocellulose $C_{12}H_{22}O_{11}$ is the chief product formed. Since then, much work has been done on the hydrolytic action of sulphuric acid on cellulose with a view to throwing light upon the structure of this complex carbohydrate, but, so far as the writer is aware, no one has studied the effect of very dilute acid upon the tensile strength of the cotton fibres.

The investigation described in this paper had for its objectives:

(1) The determination of the decrease in tensile strength of cotton yarn when exposed to very dilute sulphuric acid at different temperatures and dried.

(2) The effect of the temperature of drying on cotton yarn after contact with the dilute acid.

(3) Improving conditions of carbonizing of wool and woolen piece goods.

When sulphuric acid of about 1.45-1.50 density is allowed to act upon cotton for several hours at room temperature, then well washed and dried at 40-50° C. complete disintegration of the fibres to a white powder takes place. This powdery substance is mainly hydrocellulose, but small amounts of oxycellulose and unchanged cellulose are also present.† This reaction is involved in the process known as carbonizing, and is used to remove burrs and vegetable matter from wool and woolen cloth. The material to be treated is soaked in dilute sulphuric acid, passed into a suitable dryer, which is maintained at 70-80° C. This treatment causes initially a hydrolysis of the vegetable matter and finally complete decomposition to a carbonaceous substance easily removed by friction.

When cotton yarn is treated with very dilute acid and dried, charring does not take place, but the fibres are more or less affected by such a treatment, as is shown by the loss of tensile strength. The microscope failed to reveal any structural changes worth noting, and where the loss in strength was less than 20%, negative results were obtained when tests for hydrocellulose were made with zinc chloriodide after freeing the yarn from the last traces of acid.

The decrease in tensile strength produced by dilute acids on 3/8 cotton yarn, under conditions described in the experimental part, is tabulated in the following tables:

TABLE No. 1.
Cotton Yarn treated with acid at 20 degrees C. for 16 hours.

Temp. of drying.	Concentration of the acid. N	N/7	N/10	N/25	N/50	N/100	N/150	N/200
20° C.	70	64	44	20	9	2	0	0
40° C.	89	83	63	42	26	6	3	0
60° C.	94	92	86	71	49	19	8	4
80° C.	97	96	94	89	80	59	33	27
100° C.	99	98	96	92	88	67	51	40

TABLE No. 2.
Cotton Yarn treated with acid at 38-40 degrees C. for 1 hour.

Temp. of drying.	Concentration of the acid. N	N/7	N/10	N/25	N/50	N/100	N/150	N/200
20° C.	75	70	47	29	11	6	4	0
40° C.	92	87	72	56	32	9	6	4
60° C.	95	94	88	75	55	22	12	8
80° C.	98	97	95	90	83	62	38	33
100° C.	99	99	97	93	90	72	56	45

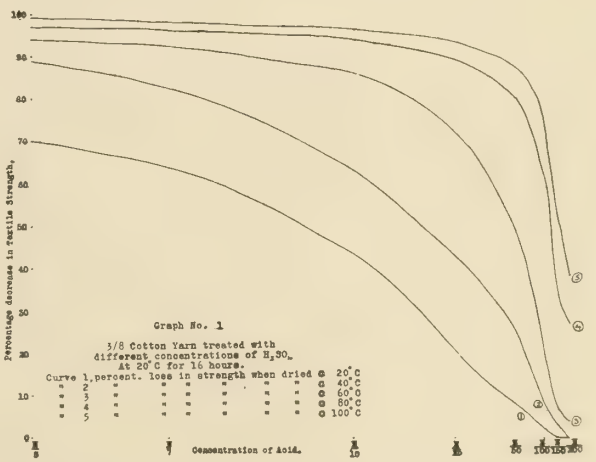
TABLE No. 3.
Cotton Yarn treated with acid at 58-60 degrees C. for 1 hour.

Temp. of drying.	Concentration of the acid. N	N/7	N/10	N/25	N/50	N/100	N/150	N/200
20° C.	79	73	52	30	13	8	6	5
40° C.	93	89	75	59	40	14	10	7
60° C.	96	95	89	76	58	25	15	10
80° C.	99	98	96	91	85	70	44	37
100° C.	100	100	97	94	92	78	60	49

TABLE No. 4.
Cotton Yarn treated with acid at 100 degrees C. for 1 hour.

Temp. of drying.	Concentration of the acid. N	N/7	N/10	N/25	N/50	N/100	N/150	N/200
20° C.	88	84	70	37	20	11	9	7
40° C.	96	94	88	65	50	17	13	10
60° C.	98	97	91	81	68	28	19	15
80° C.	100	99	97	93	88	77	60	45
100° C.	100	100	98	96	95	84	66	56

The above data furnished the material for the graphs found below:

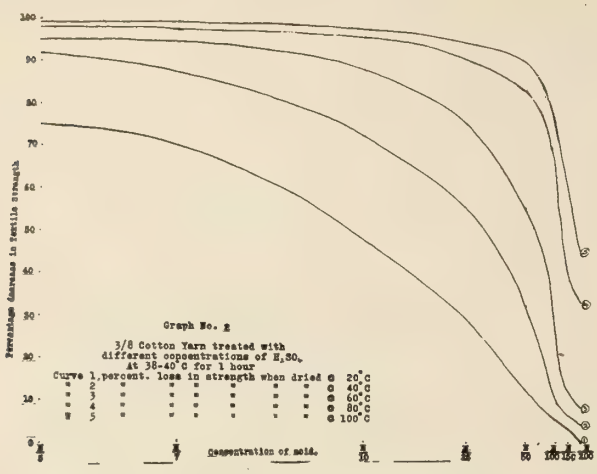

Graph No. 1
1/8 Cotton Yarn treated with different concentrations of H_2SO_4 At 20° C for 16 hours.
Curve 1, percent. loss in strength when dried @ 20° C
" 2 " " " " " @ 40° C
" 3 " " " " " @ 60° C
" 4 " " " " " @ 80° C
" 5 " " " " " @ 100° C
Percentage decrease in tensile strength.
Concentration of Acid.

These results clearly demonstrate the sensitivity of cotton to very dilute acids and show that where mineral acids or easily decomposable acid salts are used in dyeing or bleaching of cotton yarn or goods containing cotton, care should be taken to effect complete neutralization, especially when the goods are to be dried by heat.

It will be observed from the data obtained that the temperature of drying cotton after contact with very dilute inorganic acid is of more importance than the concentration of the acid within certain limits. For instance, cotton yarn treated with $\frac{N}{100}$ acid at 20° C. and dried at that temperature lost but 2% of its strength, but when dried at 100° C., lost 67%, which is approximately the loss produced by $\frac{N}{5}$ acid and drying at 20° C. Weak acid solutions, with a

* Girard, Ber. p. 2834, 1881.
† Buttner and Neuman, Zeit. Ang. Chem., p. 2609, 1908.

concentration less than $\frac{N}{50}$ have little immediate effect upon cotton, provided the drying takes place at room temperature, but will tender more or less with age.


Graph No. 2
3/8 Cotton Yarn treated with
different concentrations of H_2SO_4
At 38-40° C for 1 hour
Curve 1, percent. loss in strength when dried @ 20° C
" 2 " " " " " " @ 40° C
" 3 " " " " " " @ 60° C
" 4 " " " " " " @ 80° C
" 5 " " " " " " @ 100° C
Percentage decrease in Tensile strength
Concentration of acid.

An examination of the tables will show that the temperature of the acid solution with which the cotton is treated is also important. The tensile strength decreases the higher the temperature of the sulphuric acid. It is thus evident that before one can decide as to whether a certain treatment which exposes acid to very dilute inorganic acids or acid-forming salts will be harmful, three important factors must be considered:

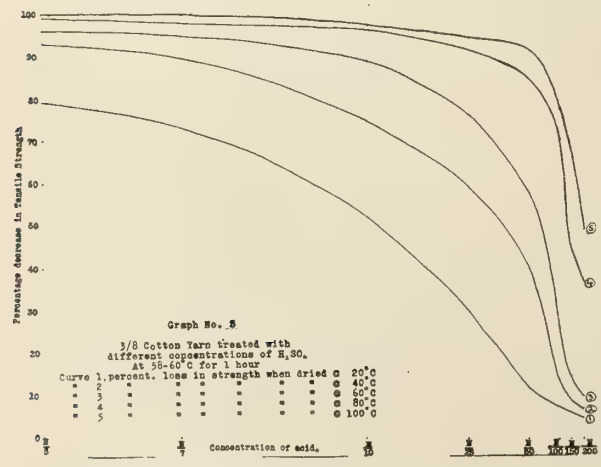
(a) The concentration of the dilute acid.

(b) The temperature of the solution containing acid.

(c) The temperature at which the cotton will be dried.

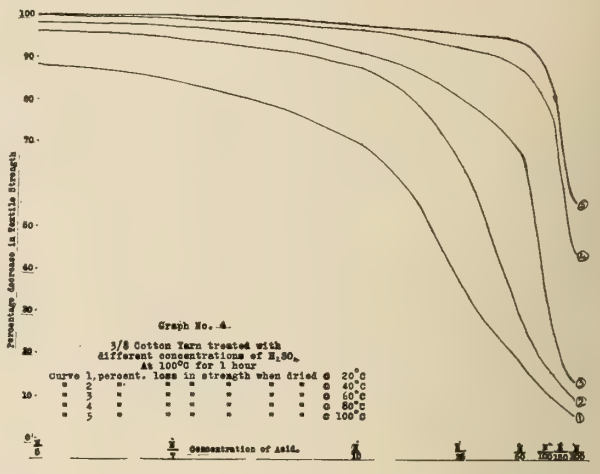
From the data contained in the foregoing tables and graphs, one can determine the limits of safety and decide on the amount of acid to use, if its use is unavoidable. Cold treatment and subsequent neutralization are essential if the solution contains more than ½% acid; solutions above 2% acid content should never be used where cotton is present.

The observation made by Stern* that cotton which has been disintegrated by treatment with mineral acid and washed free from every trace of acid, is not blackened when


Graph No. 3
3/8 Cotton Yarn treated with
different concentrations of H_2SO_4
At 58-60° C for 1 hour
Curve 1, percent. loss in strength when dried @ 20° C
" 2 " " " " " " @ 40° C
" 3 " " " " " " @ 60° C
" 4 " " " " " " @ 80° C
" 5 " " " " " " @ 100° C
Percentage decrease in Tensile Strength
Concentration of acid.

heated at 100° C., was found to be correct. The reverse of this statement is occasionally met with.

The method of carbonizing as practised in many factories calls for a sulphuric acid bath of a density between 1.025-1.035 (3.5%-5.25%) at room temperature, and a subsequent drying up to 70-80° C. can be improved by decreasing the acid content of the bath to about 1.5% H_2SO_4 keeping the temperature at 40° C. and drying at 100° C. Not only will a


Graph No. 4
3/8 Cotton Yarn treated with
different concentrations of H_2SO_4
At 100°C for 1 hour
Curve 1, percent. loss in strength when dried @ 20° C
" 2 " " " " " " @ 40° C
" 3 " " " " " " @ 60° C
" 4 " " " " " " @ 80° C
" 5 " " " " " " @ 100° C
Percentage decrease in Tensile Strength
Concentration of Acid.

saving of acid be effected but where the material has to be neutralized after carbonizing less alkali will, of course, be required. Woolen piece goods have, by actual test, been found to dye more level and have a better "feel" when carbonized with less acid and higher temperature.

Experimental.

The cotton yarn used in these experiments was of a high grade and of the following specifications: Cotton yarn, ⅜ths; moisture, 4.9%; ash, 0.93%; tensile strength, 2.378 kg. (average of 40 determinations); twist, per meter, 325; meters, per gram, 3.96.

Eight different concentrations of sulphuric acid were used, viz., $\frac{N}{5}$, $\frac{N}{7}$, $\frac{N}{10}$, $\frac{N}{25}$, $\frac{N}{50}$, $\frac{N}{100}$, $\frac{N}{150}$, $\frac{N}{200}$; normal sulphuric produced in nearly every case complete loss of strength. Four different temperatures of treatment were used, which approximately correspond to conditions existing in a textile plant where cotton is exposed to weak acid solutions. To obtain the influence of heat in the drying of cotton previously exposed to acid, five temperatures were used in the experiments, viz., 20°, 40°, 60°, 80°, 100° C.

For the tests, fifteen yards were measured from skein and cut into one-yard lengths. Six lengths were picked at random and the tensile strength determined. The average was taken to be the average strength of the whole fifteen. The remaining nine lengths were then immersed in 50 c.c. of the acid, care being taken to thoroughly wet the cotton with the acid solution, then treated at the various specified temperatures for one hour, with the exception of experiments recorded in Table 1. All of the acid solutions were heated in a Freas oven. Each beaker was covered to prevent evaporation, and a small thermometer inserted in the cover so that the acid covered the mercury bulb and a quarter inch of the stem. The oven was regulated according to the readings of the thermometers.

After treatment, the cotton yarn was removed from the beakers, gently squeezed, then placed between filter papers for two to three minutes, then dried in the electric oven at the specified temperature. Before determining the tensile strength of the treated cotton yarn, it was given 18 hours' exposure to air to permit the usual "regain" to take place.

* A. L. Stern, Jour. Soc. Dyers and Col., p. 121, 1904.

The average value of the nine determinations of the strength was divided by the average value obtained from the six untreated lengths of yarn and the percentage loss thus ascertained.

Summary.

(1) Cotton fibres are sensitive to very dilute sulphuric acid solutions, especially when allowed to dry on the fibre.

(2) The higher the temperature of the solution containing inorganic acid and the higher the temperature of drying cotton treated with such a solution the greater is the loss in tensile strength.

(3) Carbonization of wool and woolen cloth can be best effected by using a warm (40° C.) acid solution of a density 1.010 (1.5% H_2SO_4) and a drying temperature of 100° C.

Research Laboratory,
Toronto Carpet Mfg. Co., Ltd.,
Barrymore Cloth Co., Ltd.,
Toronto, Ont., July, 1919.

The Growing and Milling of Corn.

An Account of Corn Production in America with Remarks Relating to the Problems Connected with Milling, Grading and Testing Corn Products.

By W. F. GEDDES*

THE early culture of corn probably originated in the high plateau region of Southern Mexico about the beginning of the Christian Era, as specimens of corn have been found in connection with ancient ruins and geological formations at least two or three thousand years old. From Mexico the culture of corn spread North and South, and it was found to be in general cultivation by the Indians of both North and South America when Christopher Columbus discovered America. The Indians grew chiefly flint and flour corns, because of their keeping and germinating qualities. Following the discovery of America, corn was introduced into Europe and is so widely grown to-day that it has become one of the world's most important food plants.

Corn Statistics.

The relative importance of corn as compared with other cereals may readily be noted from recent statistics of the world's crops. The corn crop ranks first in number of bushels produced, being followed by wheat, oats, rice and barley. In money value the world's wheat crop ranks first, the potato crop second and the corn crop third. The United States produces 73 per cent. of the world's corn crop, the greater percentage being produced in one section known as the corn belt, comprising the States of Illinois, Iowa, Missouri, Nebraska, Indiana, Kansas, Texas, Ohio and Oklahoma. The following table shows the importance of the United States corn crop in 1918:

Corn	2,839,017,000	Bushels
Oats	1,300,000,000	"
Wheat	1,001,071,000	"

Perhaps no other cultivated plant in America has been the object of so much study and attention with the object of adapting it to the various soils, climates and needs of man, as the corn plant. The plant is large and lends itself well to detailed study, responding readily to care and selection. In fact, most of the modern varieties in general use in North America have been developed during the past century. Selection, both artificial and natural, together with crossing, has furnished a great many varieties from which to choose. A good example of the manner in which corn responds to selection is given in Bulletin 128 of the Illinois Agricultural Experimental Station, where ears of a single variety were selected for high protein, low protein, high oil and low oil content respectively. After ten years' selection the high protein corn contained almost twice as much protein as the low, while the high oil selection contained nearly three times as much oil as the low.

Climatic and Soil Requirements.

The climatic and soil requirements of corn are quite definite. Corn differs somewhat from other cereals in being able to adjust itself to the growing season. Some North Dakota varieties of corn will mature in eighty days, while Gulf States varieties require 200 days to reach maturity. For a large part of the United States the length of the growing season is an important limiting factor in production, as the ability of corn to yield will increase with the length of the growing season up to two hundred days. As the tropics are approached frosts cease to limit the growing season, yet there is usually a dry period which serves as a limit. The moisture available for the corn crop is another important climatic factor in corn production. The transpiration of 14 to 20 tons of water is required to produce one bushel of corn. Any system of culture that will serve to prevent run-off on the one hand and to decrease evaporation on the other, will proportionately increase the available water supply for the crop.

Climatic factors are mostly out of our control except that the effect of rainfall may be modified, hence our principal efforts in increasing corn production should be in the treatment of the soil. Corn, especially, enjoys a large supply of nitrogen, and will flourish in soils so rich in available nitrogen that other cereal crops would produce an excessive amount of straw and make a poor yield of grain. Corn is able to make use of fertility furnished through the decaying of coarse organic matter, while other cereals, as wheat and oats, require for best results a more advanced state of decomposition with the elements more easily available. As the gross income from cereals is small, the soil must necessarily be maintained in a productive state at the lowest possible cost. This condition is met by plowing under all organic matter grown on the land.

Corn requires a thoroughly drained soil both because it flourishes in a "warm soil" and because it requires large amounts of available nitrates when making its rapid summer growth. Water-logged soils interfere with the bacterial activity and the normal nitrifying processes are prevented.

It is not the purpose of this article to relate the cultural methods practised in the growing of corn, nor the various methods of harvesting. In the Corn Belt States the general

* Chemist, Corn Products Co., Ltd., London Ont., September, 1919.

practice is to harvest the ears only. They are generally husked directly into a wagon and stored in slatted cribs to provide ventilation. Shrinkage of total weight occurs, due to the loss of moisture in drying. When ready to market, the ears of corn are shelled with power shellers, hauled to a local elevator and shipped either direct to the consumer or to one of the terminal elevators where the grain is stored.

Perhaps nine-tenths of the corn crop is fed to stock, the remainder being used in the arts, in the manufacture of glucose, starch, cornmeal, hominy, breakfast foods, corn oil, alcohol, etc. The husks are used in matting, the stalks and pith in packing, and corn cobs are used in making tobacco pipes.

Corn meal and hominy have been important articles of food among American people from Colonial days. The principal corn meal market is in the Southern States, where it is extensively used by the people of both races, and is the principal cereal food. In many regions of the Southern States, corn meal in some form or other is eaten three times a day; wheat flour being of secondary importance and in some cases a rarity.

Mill Practice.

In general, the Southern mills grind the corn by stones, and the composition of the meal does not differ in composition from the whole grain, except for the removal of a small amount of chaff by a simple fan device. Stone-ground meal, owing to the presence of the germ, is characterized by its rich, oily flavor, the taste for which, when once acquired, is not satisfied by degerminated meal in which the fat content is reduced to a minimum. The whole kernel, stone-ground meal, must be ground locally and consumed within a short time, as it rapidly deteriorates, becoming rancid and unfit for human food. For this reason the roller process of milling has largely replaced the old method of grinding with stones. This process is very similar to that used in the milling of wheat. The shelled corn is received in car lots and carried into the mill by means of a belt conveyor, passed over a separator to remove the dust, broken cobs, etc., and stored in concrete silos. When required for milling the corn is removed from the bottom of the storage reservoirs by means of a screw conveyor. It is passed through a separator, where it is thoroughly aspirated, thus removing foreign grains, dust and impurities of a light, fluffy nature. The clean corn is passed over a magnetic separator to remove nails, etc., and then goes to the milling bin. The corn is fed from the milling bin into the tempering device, where it is tempered with steam and water, the quantity used varying from three to six per cent., according to the nature of the corn. The tempered corn goes to the degerminator, where the kernels are broken open, the germs broken away from the starchy portion of the grain, and the bran removed. This broken material is then dried to a safe moisture content in revolving horizontal cylinders equipped with steam-heating coils. From the drying cylinders, the corn passes to the coolers, which are very similar in construction to the dryers, but lack the heating appliances. The broken material is then elevated and passes through a sizing reel, which partly separates the germ and smaller starchy portions from the bran and large, flinty portions or grits. The grit stock is then thoroughly aspirated, thus removing the bran, dust, and most of the remaining germ.

Further drying of the grits is sometimes necessary for safe keeping. This is accomplished by means of a special dryer, the grits being afterwards cooled and conveyed to the storage reservoirs.

The finer stock, consisting of small grits and germ, that passed through the sizing reel, is then subjected to a gradual reduction in order to remove the germ and produce a fancy table meal. The material is passed through the first, second and third break rolls, being screened and thoroughly aspirated after each break. The germ does not break up on the rolls, but merely flattens out, thus providing a means of separation. The germ, bran, dust and other offal is turned into the feed stream and ground into feed, producing a high-grade product, particularly valuable for its high fat content, as the corn germ contains approximately 30 per cent. fat. The fat content of hominy feed from different mills varies somewhat, but generally runs between 7 and 9 per cent.

A mere outline of the process has been given, but it must be clearly understood that a properly equipped corn mill is quite complicated, with its series of conveyors, elevators, sizing reels, aspirators, dust collectors, etc., requiring skilled millers to operate them, and also a chemist to control the process.

Factors in Production.

The history of corn milling shows that until quite recently the manufacture of corn products has been steadily decreasing. One of the chief reasons for this was lack of efficiency and proper methods of manufacture, the result being that a large percentage of the corn products on the market were more or less perishable. The Bureau of Chemistry of the United States Department of Agriculture, realizing the value of corn as a human food, has devoted a great deal of time and study to the cause, detection and prevention of spoilage of Indian corn. While we are by no means acquainted with all the factors concerned in the spoilage of corn products, yet certain chemical factors have been found to greatly influence the keeping qualities. The three most important factors from the standpoint of the corn miller are, moisture, fat and acidity. These three factors are so closely interlinked as to be inseparable. As a result of many analyses in our laboratory and the government investigations, it has been found that the increase in the acidity of corn and corn products varies more or less directly with the moisture and fat content.

In Bulletin 102 of the United States Bureau of Chemistry is published the results of exhaustive tests in order to establish a satisfactory criterion for judging the quality and soundness of corn in a scientific manner. Numerous chemical analyses were conducted and the degree of acidity was chosen as the one important chemical factor in establishing the condition of the corn, because as a result of the investigations conducted, it was found to be the only chemical factor showing a perceptible change as the corn "went out of condition."

Moisture and Acidity.

In commercial grading of corn, the percentage of moisture is the primary factor since, from the standpoint of storage and transportation, the quality of corn is directly dependent upon the moisture content above certain limits. From the time of harvest until April and May, the corn arrives at terminal markets with an excessive per cent. of moisture. After a certain time the moisture of the corn becomes normal and hence moisture ceases to be a factor in grading. Quality and soundness or the percentage of damaged kernels are then considered. The Bureau of Chemistry, however, found that the "degree of acidity"

of the corn is in direct relation to the factors of moisture, quality, soundness and per cent. of damaged kernels. All corn, even at time of harvest, shows a certain degree of acidity, and as the corn becomes older the degree of acidity increases, due, almost entirely, to the deterioration of the germ, which is responsible for most of the acid in the corn, and especially the increase in acid.

Since acidity is confined chiefly to the germ, or fat portion of the corn kernel, one of the important factors in the manufacture of safe corn products is the proper reduction and elimination of fat. Further research has shown that the increase in acidity is much more rapid where excessive moisture is present, in fact, moisture is the most important of the controllable factors causing deterioration, and it is very essential that corn products be dried to a safe moisture content. While the amount of moisture essential to proper keeping qualities is not definitely determined, we believe that corn about 14 1-2 per cent. moisture or corn products 11 to 14 per cent., depending on the fat content and the size of the particle, are secure from spoilage or germination. It is always noticed that cracked corn or broken grains show the first signs of deterioration, showing that a lower moisture content is necessary in corn products, after the skin or nature's hermetic seal has been broken and the germ is subject to the action of bacteria. In the milling of corn, therefore, a proper method of drying the corn products after degermination must be supplied, as well as a means of controlling the extent of drying. For control work the ordinary method of obtaining the moisture by drying the sample to constant weight is too slow. Brown and Duvel have perfected a rapid method for the determination of moisture in grains and other substances, the method consisting of heating whole grains, seeds, meals, etc., in a mineral oil having a flashing point much above the boiling point of water, in condensing the water which distils off, and in collecting and measuring it in a suitable graduate. The apparatus has been carefully standardized and enables the chemist to have his results in the hands of the miller one-half hour after the samples have been received. This apparatus is a boon to corn millers, providing accurate data for control of the kiln dryers.

Kiln-dried corn, which is dried by a slow process, will germinate, and many millers, therefore, claim that reduction of moisture alone is not sufficient to guarantee safe corn products, but that this reduction must be brought about by an intense heat for a short time, thus killing the bacteria, which are responsible for the deterioration of the product. After sterilizing it is essential that corn products be cooled before packing or storing, especially when storing in concrete reservoirs. Unless the products are thoroughly cooled, "sweating" is very likely to occur, causing deterioration and rapid increase of acidity.

It is the writer's belief that the keeping quality of corn products may be made equal to that of wheat flour by careful milling and scientific control. The firm with which the writer is associated has made shipments of corn meal to the West Indies, the shipments being three to four months in transit. The meal arrived in excellent condition and met with ready acceptance. Corn is a valuable human food, and it is the duty and privilege of the miller to furnish it to the consumer in a non-perishable form. The American Corn Millers' Federation has been of mutual benefit to corn millers, and it is largely due to the activities of this organization that the consumption of corn products is on the increase.

THE SAVING OF MINERS' LIVES.

On September 29, 30 and October 1, the new laboratories of the United States Interior Department's Bureau of Mines at Pittsburgh, Pa., costing more than one million dollars, were dedicated. The feature of the three days' ceremonies was the Nation-wide First-Aid and Mine Rescue Contest, in which nearly 100 teams from the coal and metal-mining companies of the United States competed. The Bureau of Mines has of late years been very active in efforts to decrease the number of fatalities among the workmen engaged in mines. Even with all these efforts more than 3,000 miners are killed each year in the United States by accidents. Speaking of the work of the Bureau of Mines in this direction, Dr. Van H. Manning, Director of the Bureau, said:

"I am often asked: 'What has the Bureau of Mines accomplished in saving of human life in the mines?'

"It is difficult to say that so many miners might not have been killed if it were not for the Bureau of Mines, there are so many varying factors involved. I may say however, that if you consider the prevailing average death-rate in the mines for a period of years before the Federal Government took up this work, and compare it with the average fatality rate since the Bureau was created, you will find that 5,000 less miners have been killed. In other words, had the old fatality rate been maintained through the last few years, 5,000 more men would have lost their lives.

"To-day the Bureau of Mines maintains in every mining field of the country a mine rescue-car, fully equipped with modern life-saving apparatus, that responds to disasters and assists in the rescue work; in the meanwhile visiting the mines in its district and giving the miners training in both mine-rescue and first-aid to the injured.

"Mining will always be an extra hazardous business; there will always be dangers inherent to the industry that will ever take a death-toll, and beyond which it will be impossible to reduce the death-rate.

"But the question is: 'Have we reached that irreducible minimum?' No, I think not. It is my belief that we can cut down the present fatality rates fully one-half; that we can save each year 1,500 of the 3,000 killed every twelve months. Isn't such a goal worth striving for? A prize of 1,500 human beings saved to life, happiness, their families each year!"

BAHAMA ISLAND TARIFF.

The new schedule of the import and export duties for the Bahama Islands shows an increase of fifty per cent. in the tariff on lard compounds and substitutes.

SMELTER FOR BROCKVILLE, ONT.

The Consolidated Iron & Steel Corporation, 20 King Street East, Toronto, are planning the erection of an iron smelter at Brockville, Ont., at an estimated cost of $8,000,000.

STEEL PLANT AT NIAGARA FALLS.

Reports received from Niagara Falls, Ont., state that a large steel plant will be erected there, and that erection work will commence immediately. The main output of the company will be electric steel castings. As yet the name of the new concern has not been made known.

The Future of the Electric Furnace.

By C. T. BRAGG*

"A PROPHET is not without honor, save in his own country."

Also it is perfectly true that he is often honorless everywhere else. However, it is perfectly safe to make predictions relative to the electric furnace. Its future is to be better than its past and cannot but be an improvement on its present. It is rapidly becoming necessary to classify electric furnaces with relation to type as well as use. Heat from the electric current may be obtained in more than one way and is used for more than one purpose. It is certain, however, that the arc, resistance, high frequency and other types of furnaces, whether they be adapted to steel making, brass melting, heat treating or other industrial uses have bounded into our midst with the grim appearances of visitors who expect to remain.

The brass melting type of electric furnace is most actively taking the attention of engineers and metallurgists at the present moment. Its development has been slower than either the heat treating or steel melting furnace for several reasons. The problem is entirely different because of the fact that a varying condition of melting points, tendencies to oxidation, distillation points and the narrow limits for final pouring temperatures have complicated the issue and in one way or another retarded development. In addition, generally speaking, brass manufacturers work in smaller units than steel manufacturers. The much greater value of the product of a brass manufactory per unit of weight naturally restricts in size as compared to the average steel producing institution. This has had the effect of forcing electrical industries to do most of the initial work and foster the development of the furnaces. There are notable exceptions to this condition, but in general it holds true.

At this time it may be said, advisedly, that in all its types and for all its uses, the electric furnace is on a plane of direct competition with any other means of obtaining industrial heat, most of the problems remaining are those of refinement or application, none of them are electrical. There is no doubt that something can yet be done to stabilize the operation of those furnaces depending on mechanical movements to gain even distribution of heat and thorough mixing. Something can yet be done in resistance type furnaces to lengthen the life of various secondary parts. In the brass industry the pyrometer is not yet perfectly adapted to any type of furnace. This is largely due to the corrosive action of zinc vapor on the protecting tubes and will no doubt soon be overcome; generally speaking, the problem most needing immediate attention is that of linings. The speed of operation with consequent acceleration of output brings very severe conditions to bear on the linings with consequent rapid wear. This problem is now receiving a great deal of attention and the condition is improving rapidly.

The cost of operation of any type of brass melting furnace is naturally variable for different locations and different outputs, but may be confidently assumed to be lower than other means of melting. Necessarily, only a general statement can be made with reference to operation charges, but the statement above is conservative and takes into consideration all the adverse conditions mentioned before.

In attempting to predict what future favor the electric furnace may find, one thing must not be forgotten, and that is, that the average man has a streak of romance in his nature and some poetry in his soul. That is just another way of saying that no matter how cold a business man may be, or how serious an engineer may consider himself, both of them are susceptible in some degree to other influences than purely business ones; in other words, every one likes electrical contrivances, and the idea of operating electric furnaces appeals to us.

Every one knows now that there is no difference between electricity and the material which it affects in the electric furnace; that is to say, there is no difference excepting in the arrangement of its electrons. Sir William Ramsay contended that he found helium in an old Crooke's Tube. When we remember that helium is a product of radium and that lead is also a product of radium, it becomes possible to let the mind wonder through the limitless possibilities of the connection between electricity or energy and material things. Is it not possible that that peculiar hidden law which brings discoveries to light just at the time they are most needed will bring to our attention peculiar effects of the electric furnace, of which we now have no knowledge? In other words, it is going to be necessary to study the effect particularly in the Arc Type Furnace of electricity upon the product. It seems highly fitting that our most remarkable method of displaying energy should be harnessed in such a way as to bring to bear the maximum amount of effect in a minimum amount of time; however, we must not forget that so intangible an agent may have many tangible possibilities which have as yet been untouched. The matter of controlling the structure of our various metals may be within our grasp.

* Works Manager, Michigan Smelting & Refining Co., read before American Institute Chemical Engineers, Boston, June 18th, 1919.

AMERICAN SULPHUR OUTPUT.

The quantity of sulphur mined in the United States during 1918 was 1,353,525 long tons. This compares with 1,134,412 long tons in the previous year, 649,683 in 1916, and 520,582 in 1915. The approximate value of the output last year was $27,868,000.

ATOMIC ENERGY AND POWER.

Sir Oliver Lodge, in an address at the Midland Institute, England, September 17, on the occasion of the one hundredth anniversary of the death of James Watt, inventor of the condensing steam engine, in referring to the atomic properties of matter, declared that if the atomic energy of an ounce of matter could be utilized it would be sufficient to raise the German ships sunk in the Scapa Flow and pile them on top of the Scottish mountains. He added, however, that he hoped the human race would not discover how to use this energy until it had brains and morality enough to use it properly, or otherwise the discovery would, in immoral hands, probably make the planet Earth unsafe to live on.

The Value of Scientific Work and the Training of Chemical Engineers in Canada.

A Portion of the Detailed Report of Proceedings of the Chemistry Committee of the Honorary Advisory Research Council.

Note.—The following is taken from a full and authorized report of discussions by members of the Committee at the May meeting, 1919.—Editor.

DR. McINTOSH.

IN the last few years I have noticed a great tendency in the universities to take up questions which have commercial bearing rather than a strictly scientific one. I am not at all sure that the term "strictly scientific" is a good one.

I think we ought to remember that everything worth while in industry has come from researches which have had no commercial basis really. I do not care what you take, whether it is X-Rays, wireless telegraphy, liquefaction of gas, radium or anything else, all these things have started purely from the scientific side. Now, however, the tendency for universities is to take up quite other subjects, and a great deal of it, I think, is due to the Mellon Institute, and I have nothing to say against the Mellon Institute. I do not think it would hurt in the slightest to go through with any of these problems, but for our younger men, the men who are just graduated in the university, I think the work picked for them should be picked so that its interest is largely scientific rather than commercial. If you are looking over the problems that the young men take up, or are forced to take, you will find a very great variation in them. One of them I had occasion to see something of in the last day or two; it appeared to me an admirable problem. Some men were endeavoring to make a substance that had never been obtained but in the pure state. They had to use great skill in getting this substance, so if the research stopped there, simply in attaining it, it would be an excellent research for the young men. But they were going much further than that. Amongst other things, they showed me some complicated and strange curve in this. I do not think the study of this combination will mean much to industry at the present time, but I am quite sure that the man who is undergoing that training, when he goes out to some smelter, is going to be of the very highest value to him and to the particular company with which he is working. I have another problem in mind which was taken up by a young fellow. It was a question in laundering. A man washed collars a certain number of times and dried them, ironed them, and he came to the conclusion that a great part of the deterioration in the collar was due to moistening it, and he even determined the amount of deterioration. Well, that is, no doubt, a very useful problem and a very worthy problem, but I think the man who volunteers a research of that character is no better chemist than when he began.

I have a little experience in working with various companies and I find that the managers of the companies, the men who are interested in the research of their company, are very much more likely to take a man who has spent his time on a scientific question. I have one case of that in mind. A man in one of our various successful and large chemical companies in the United States had occasion to get a chemist for research. He looked over the applications from various men who applied for the position and he picked out, finally, a man who had published a paper on the number of centres during the crystallization of super-cooled liquids. Now, I cannot imagine any problem further away from the practical than that, and I asked him how he happened to pick up this man. The man gave good acquaintance with scientific literature and he picked him, not thinking that perhaps the man, the first year he had been with the company, would do so much as the man who would do strictly practical work, but in the belief that a man of that type would be more valuable to the company after four or five years. I just give another example or two that came under my own experience. All the chemists here have occasion, from time to time, to make sodium amalgam. The problem came up where, say, one or two per cent. amalgam had to be prepared. It was turned over to a man who had an excellent training in inorganic chemistry. He knew something about heats and combination, and in a very short time the problem was solved that he could make 100 pounds of this amalgam in the morning without any danger to any one in the concern or without any loss. I think he had only been able to do that on account of the real training he had in scientific work. I can give a dozen problems like that if I had time. In the zinc industry, where we use about 6 per cent. or 7 per cent. zinc solution, it was found out that the zinc could not be deposited; it would not come down; the whole plant was tied up, and after a great deal of work it was found that about 10,000 of 1 per cent. of cobalt or nickel in the solution produced that particular effect. Any of you who are experienced analytical chemists know the difficulty of taking 10,000 of 1 per cent. cobalt with 5 or 7 per cent. zinc. The man to whom that was given knew a good deal about chemical literature. He had to get some way to remove that from the solution, and he very naturally thought of selective adsorption, that something or other thrown down there might pick out the nickel or cobalt or whatever it was and throw out the nickel, so he started by precipitating the zinc and examining what came down. Then our solutions are fairly well saturated with calcium sulphate and there are other things in the solution. There was manganese sulphate in there, perhaps 1-10 of 1 per cent., and he knew from his analytical experience that a neutral solution would throw down manganese dioxide. He knew that other things sometimes stuck with manganese dioxide, and he brought out the cobalt and nickel sufficient for the purpose.

A thing of that kind, it seems to me, one gets from the scientific training that one gets at the university, and at the university a thing of that kind can be done very well. I have spoken to men in the big industries and I know a good many of them all over America and their advice to the university is to confine themselves to the science part of it and let the technical or super-technical part of it go.

The only reason I mention these cases is that in the education of the young men and men who are going to be

research men one should, as far as possible, pay attention to these things. So I feel that sometimes at least the universities are attempting to do the things they cannot do very well and are leaving undone a very large part that they could do excellently. I am sure if I asked my friend, Mr. Matheson, the man who worked, perhaps, on the greatest thing that has ever been done in technical chemistry in Canada, I think in America, what kind of a man he wanted on the works—a man who had experimented with his own processes here or the man who had been paying attention to the scientific part, I feel quite confident Mr. Matheson would want some one who had been working in the measurement of electric motive forces or conductivity or something of that sort.

The Training of the Chemical Engineer.

DR. RUTTAN: I am going to present another point of view with regard to the training of a certain type of chemists, viz., men who are capable of engaging in what might be called minor research in industries, that is, chemical engineering. I have had occasion in the course of an address to take up this problem, and as none of you were present, and as it has not been published, I thought I would bring before this committee a scheme for training chemical engineers, which has been introduced in the Massachusetts Institute of Technology, where they recognize it is impossible to put a chemical engineer in touch with the industries in the university, and they have adopted the plan which I will outline here, of sending their engineering students in their last year to various industries throughout the country.

The type of scientific man required in Canadian industries is something of the order of the well-trained chemical engineer.

The scientific, well-informed young chemical engineer is the crude material from which we may look for the kind of industrial research which the country needs at present and who, as circumstances or personal capacity will direct, may ultimately become a works manager or research chemist in his special field.

The great field for development of stable chemical industries in Canada is the utilization of those natural resources both in material and in forces which we possess in great quantity, and more conveniently situated than other countries. This need not call for original researches, but rather the adaption to four conditions of methods, principles and processes already known and well tried elsewhere. This is obviously the function of the chemical engineer, but to do it successfully requires a sound knowledge of fundamental principles on which is grafted a practical acquaintance with the methods and processes of industrial practice.

How can the country develop and retain men of this type, is an important question.

For the last three or four years there has been a very prolific discussion regarding the best course of training for the members of this comparatively new profession, the chemical engineer. It has become generally recognized that progress in industrial chemistry is based upon both engineering and chemistry. It has been further recognized that universities have failed in giving just the right type of education to the chemical engineer. This is due to the fact that the universities are unable to give instruction regarding the control of chemical reactions and the handling of materials in a large way. The best that can possibly be expected of the university in a course of four years is to give a foundation, broad and scientific, on which the graduate may build his profession, which is really acquired in the industry to which he subsequently devotes himself. After having once entered upon the work of his profession, it is only in very exceptional cases that a man returns to the university for further training in research. Admitting the unsatisfactory and incomplete training which is now being given the class of men to whom we must look for the development of industrial chemistry in Canada, the time seems ripe for the consideration of some plan which will provide more adequately trained chemical engineers and extend the facilities for industrial chemical research. The plan which, in my opinion, gives great promise of meeting these requirements is an adaptation to Canadian conditions of one which has been developed and is now being tried by the Massachusetts Institute of Technology, of Boston.

Plan of Massachusetts Institute of Technology.

This scheme of education was evolved by a Committee of Engineers appointed by the Institute of which Mr. A. D. Little was Chairman. It is so unique and has, up to the present time, so completely realized the expectations of those who brought it about that I propose directing your attention to it somewhat in detail. We recognize that a chemical process, whether on the laboratory or the factory scale, consists of a series of "unit" actions, such as pulverizing, mixing, heating, roasting, absorbing, precipitating, condensing, crystallizing, filtering, electrolyzing, etc. The number of these basic unit operations is not very large, and only a few of them are to be seen in any particular works. To afford an insight into the real problems requiring industrial chemical research, the Institute of Technology has established five or six chemical engineering and research stations throughout Eastern States in direct contact with important industries. These were selected with a view of bringing to the attention of the engineering student the largest possible variety of the unit operations, of which chemical processes are generally composed. These stations have a three-fold function: one, for the practical instruction of the students in chemical engineering; and secondly, the instruction of ambitious foremen and others in the works on the fundamental principles governing their operations; thirdly, the advancement of industrial research in special industries.

According to the arrangements at the Boston Institute, the students leave the university about the middle of their fourth year and spend the period from January to September in moving from station to station, giving each station a period of six weeks. An instructor is in charge of each station and maintains the same strict discipline among the students as is found at the university. Each day's work is carefully planned and daily lectures on different stages and different units of the process form a part of the system.

The student returns to the Institute to complete his fifth year by following a course of advanced lectures and doing laboratory work, the value of which he will appreciate as the result of his experience in the works. This in outline is the object and method of this new plan of educating chemical engineers. It seems to me quite feasible to apply it in a modified form to our conditions in Canada. It will require co-operation among the engineering faculties in Canadian universities on the one hand, and a successful appeal to the captains of Canadian industry. The universities must agree upon the necessity for a five-year course in chemical engineering, and be convinced that one

year spent chiefly in training in works is the best way of employing the student's time. Many of the large schools in the United States are already requiring five years for the degree in chemical engineering. It is evident, however, that the success or failure of such a plan will depend very largely on the manufacturers. Without their cordial co-operation and assistance the plan is obviously doomed to failure. The Honorary Advisory Council for Scientific and Industrial Research has appointed a committee to look into this question, and if the general principles are acceptable to the Canadian universities and to the manufacturers, to formulate a plan for putting it into effect in the very near future. It seems to be, in addition, a very obvious and effective method of bringing into closer relation the universities and the industries of Canada, enabling the former to ascertain the important industrial problems of the country, and giving the industries an opportunity of utilizing, in part, the teaching and research powers of the universities. Not only would this scheme give our students in chemical engineering a range of experience impossible to obtain otherwise, but the stations could offer special courses in the technology of their industry to superintendents, foremen, etc., thus forming a sort of university extension in chemical industry. Continuous and intimate intercourse would be maintained between teacher and student. The instruction would become a veritable bedside clinic, where an industrial unit would be the patient whose physiology and anatomy are being studied in every detail.

The plan lends, also, itself with peculiar effectiveness to the development of industrial research at each station, as the Director in charge of the station would of necessity be a well-trained chemist or chemical engineer who has specialized or intends to specialize along the lines of the particular industry or industries with which he is connected.

Application to Canadian Conditions.

To apply this scheme of training to Canadian conditions will not be so easy when the details are to be worked out. Many difficulties suggest themselves. In the first place, the total number of graduates in chemical engineering and chemistry in Canada is much less than is annually turned out by the Institute of Technology. Hence, the field from which we can select students is smaller. Their average student is financially better able to spend the extra year with its additional tuition fees and travelling expenses than is our Canadian student. Again, few of our industries are on a scale comparable with many in the United States. In other words, the clinical field for instruction is more limited, but these and other suggested difficulties are more apparent than real.

There is but little doubt that industrial chemistry is offering such a future to our technically trained graduates that chemical engineering is rapidly becoming the most attractive career for the engineering student, and the required number will soon be available. If the universities gave the Bachelor Degree at the end of four years and a Master's Degree in Science after five years; if the fees be made as low as possible, the obvious value of this practical training is such that competition will result among the students for the privilege of being admitted to the course. Substantial Government aid in sustaining the teaching staff is, of course, essential.

Again, instead of selecting four or five large, single industries for stations, one or two of the greater industries, such as sugar, paper and pulp, cement, or starch might be utilized, and the remaining stations placed near a group of kindred universities, each of which would contribute its quota towards the establishment of the station and receive its benefits; such as the Niagara Falls and Shawinigan, the Alkali Chlorine and salt industries of Western Ontario, etc.

These stations will in each of these centres in time become a bureau of scientific information and research for the neighboring industries, and will go far towards introducing an atmosphere of science in those industries in which chemistry plays a part.

Finally, I feel strongly that the chemical engineer so trained is just the type of man to develop our industries. He would be a university man familiar with the engineering problems presented by chemical industries, one whose capacity for initiative and for attacking scientifically an industrial problem would be many times that of the present science graduate, however adequate his university training may have been.

Engineering vs. Research.

Now, that is another phase in connection with the possible means of training chemical engineers. The chemical engineer need not necessarily be a research man. The chemical engineer combines in his person the old-fashioned physician and surgeon, the old-fashioned family doctor. He is neither a highly-trained surgeon nor was he a particularly good physician in the modern acceptation of the term, but he was a very useful, all-around man, very essential to the health of the community, so I think that chemical engineers trained in such a way as this would be extremely useful men for actual operations in industrial works, even though they are not thoroughly trained chemists nor expert engineers. It is a plan which we discussed at the very beginning of our activities in the Advisory Council, but it was in war time and it was practically impossible to put such a scheme before the public. Now, I propose having this brought again before the Advisory Council, and before doing so I would like very much to get a careful criticism of the members of this committee with regard to its practicability. Supposing we would be able to obtain a sufficient grant through the Advisory Council to maintain three, perhaps, or four men in different centres and works in Canada; do you think the plan a practical one for us? The works themselves in the United States are called upon to provide a laboratory, to equip that laboratory and to keep it up. In return, the works receive the advantage of having research men on the premises and an opportunity of having their foremen and their junior technical men receiving a certain amount of education. On the other hand, it gives an opportunity of bringing the universities in very much closer contact with the industries of the country.

DR. GOODWIN: There is a modification which suggests itself to me. It is the first time I have heard of this, and I have not had time to think it out and see it in all its bearings, but carrying out my idea of getting as close an intermingling as possible of the universities with the industries, my suggestion of the modification would be this: That the men who are selected for those posts should be teachers in the universities, that they should spend only part of their year at those posts, and in that way they would come back to their teaching duties refreshed by a change of work and with a new outlook upon the importance, relative importance of the different parts of their subjects. It strikes me at first sight—I would not like to speak dogmatically about it all, but it strikes me at

first in this way: you would strengthen both sides of the situation, both the university side and the industrial side, by bringing them closer together. You would improve the power of the teacher, too. That is the thing I fasten upon particularly, improve the outlook of the teacher upon his subject for his students and guide them in their studies.

Harking back a bit to the opening of the discussion, to Dr. McIntosh's contribution to it, I should like to say that it seems to me that we make too much distinction between the practical and the useful and the purely scientific side of this question. As all of us know, the pure science of to-day become applied science to-morrow, and it seems to me that that is getting so nowadays that the one is treading so closely upon the heels of the other that you cannot separate them, and while we are perfectly right and sound in our view of it, we must first thoroughly train the prospective research student for works engineer in the fundamentals of science, give him his first introduction to research in some problem which does not raise the question of usefulness at all. Yet it strikes me we stop here. We have not gone far enough in our process of training.

MR. H. W. MATHESON: We have had considerable experience in the last five or six years in developing an industry, first of all from a scientific standpoint, and then applied it on a large scale. I can hardly second Dr. McIntosh's statement that the first fundamental for the research man is a thorough scientific training. At the present time we are organizing quite a large research department and in looking over the field for men we have advertised pretty extensively both in the States and in Canada. We find a considerable dearth of properly trained men in Canada. I think the question of the training of these chemists is a very important one.

To go back to the second stage of this subject, about training of chemical engineers, it seems to me there are two distinct fields there. The research man requires a highly scientific training, and the second question dealt with by Dr. Ruttan is the training of the chemical engineer. He is a man who works in the plant usually, and I would suggest it might be a good scheme that the chemical engineering course should be changed to five years, the fifth year being spent in taking probably four or five months in the plant and probably four or five months in the university, if you like, doing technical problems instead of teaching, as Dr. Goodwin suggests. I think it would be a good deal more valuable to him if he spent his time on technical problems instead of scientific ones. I believe that could be arranged amongst various industries. Speaking for the Shawinigan Water and Power Company, I am sure we would be glad to co-operate.

MR. WARDLEWORTH: We have had some experience, also, during the past year, and I was wondering how Mr. Matheson would handle the question of the men coming in the plant. Our plant is much smaller, but we have had applications for men to come in and get a practical training during their vacation during the summer, and the reply from the head chemist was that he would like to take them for all the time, but he would not like to be bothered with them for two months. This scheme may be modified in application. Dr. McIntosh's ideas are, no doubt, excellent, but as Dr. Goodwin says, the one follows the other so much to-day it is hard to find the dividing line.

I should like to say this, that in our experience at Ottawa during two and a half years practically that we had to deal with high explosives and propellants, we have been given as aids young men who came from universities, and we wished profoundly that they had had some practical experience in work that called for some business training or experience with actual things.

They were really good men, but they had not had the responsibility of realizing. I don't know whether they will get that in the training you are going to give these men. I do not think they realized the results they were going to hand in involved the expenditure of millions of dollars. The men did not come to see, did not realize it was a real thing they were dealing with.

Nothing, in my mind, would be better than the thing brought forward, because we should be carrying out, in a measure, the plan which has been found so successful in general, where the relation between the academic and the industrial has been carried out to a point of practical perfection, and is, in my mind, the reason of the success which has attended the efforts of the Society of Chemical Industry in this country up to the present time, namely, the bringing together of the academic and industrial.

A Three-Years' Course for the B.Sc. Degree.

DR. MACALLUM: I have always felt that our exaction of four years for the B.Sc. degree involves a heavy call upon our young scientific men who intend to go, subsequently, into scientific research. You all know that in England, in the universities of Great Britain and Ireland, the B.Sc. degree is only three years, and that has been the case ever since the degree has been instituted over there. Of course, their session, what we call the session, what would be equivalent to our session, is longer than ours. It is over eight months, but the student gets a training in sciences in three years. If that is sufficient for a degree for the British student, why should we not have the same requirement for the degree as given by us?

It is said, of course, that the reason for the difference between the British degree, the requirements of the British degree and that for the degree as exacted in Canada is that the British matriculant has higher matriculation qualifications.

Now, I have spoken on this subject to a number of graduates of Edinburgh, Liverpool, and Manchester, who know the requirements for entrance to our Canadian universities. I had the opportunity of going over the examination papers of a number of students of Liverpool and Manchester, proceeding to the degree of B.Sc., and I have read the examination papers of many thousand students in Canada, and I do not think that the standard which they showed in the answers, the style, is one whit better than ours. In fact, there were some glaring instances of lack of knowledge of the fundamental things, like grammar and statements themselves.

Why should not the student get a very good knowledge of general science and even one in particular in three years if the British student can get it?

This would permit him to take a year elsewhere or to go on into research work, where he would see whether he has the capacity and whether he can develop the initiative that is necessary to carry on scientific work. If such a student were allowed an opportunity like that, I am quite certain that he would develop better than he does now under the present system. In the University of Toronto, in the Department of Chemistry, they give the B.A. for scientific courses in four years, but the last year is spent almost wholly in research, and the student goes out with the idea that he has acquired the art and the insight that is necessary for scientific work, and he is spoiled. Would

it not be better for him to get the B.Sc. degree at the end of the three years and tell him to go and acquire the art of research and develop his own initiative in the succeeding year and pass on to a Ph.D degree. I think we would find, as a result, a greater crop of students annually and more going into scientific work, and I think it is worth while to point to that as a reform in our educational system.

PROF. CAMERON: I think the question you brought up goes, perhaps, much deeper than the university course. I think, in Canada, a great deal depends on the Province, the education given in the schools, and I hope that the other provinces are better off than we are in New Brunswick. We get students coming into college from the High School, and we have to teach them chemistry, grammar, spelling and all sort of things. I have had more misspelling in Fredericton, N.B., in one year than I had in four years in Edinburgh. I have no doubt in Ontario things are quite different.

I would just point out this one thing, that it rather surprised me—probably some of you read that article yourselves, in which a prominent man of the United States put it as his estimate that the average American student was two years behind the British student. He was a prominent university man.

PROF. MACALLUM: The conditions all over the United States are such as to predicate that. For instance, in the Western States and in the Southern States, conditions of education are such as to make it impossible to have as high an average standard as they have in England.

DR. MACKAY: Mr. Chairman, I scarcely feel competent to add very much to the discussion, but the point that Prof. Macallum has raised is a very important one. It raises the previous question of the preparation of the student for the university. I feel quite strongly that all our Canadian universities are admitting men who are not really competent to undertake, with the full benefit, the proper college work, so that the reform that Dr. Macallum has suggested would call for the previous reform of only admitting those properly qualified to undertake the work. In the United States they claim—I do not know with how much truth—that their matriculation is one year higher than ours.

DR. MACALLUM: In New York State.

DR. MACKAY: Our matriculation standard is founded upon three years' High School course; generally theirs is founded on four. My experience with medical training of High School students would not bear out the statement that they are qualified to the extent of one year's work more than ours. Certain things that seem fundamental to me in parts of the high school course, those I have come in contact with, have sometimes been sadly defective, our own three-year men being frequently very much superior to them, but my experience has not been sufficient with American students to make a general statement regarding them. I am not speaking now of admitting a partially qualified student. I am speaking of admitting students who have passed their matriculation requirements as they are at present.

PROF. MACALLUM: In the University of Toronto no student is allowed to enter a special Science course who has not taken honors in at least three subjects, that is, at matriculation. These honors mean an extra year's preparation. He is better than the average student. Why pile four years on him in addition to that?

Dr. MACKAY: I would like to inquire regarding the present matriculation requirements which so far are approximately the same for Arts all over Canada.

DR. LEHMANN: It also depends on the scientific side which they undertake after they go to the university. We always feel that for a B.Sc. course it would be better to extend the term by one year to give them that general, fundamental, sound training in Science which is required for research work.

In some universities we give comparatively little Science in the first year. It is a general course, which we might speak of as a high school course. I have always lamented that we were unable to give a good, sound, scientific education in the first year. Then, in the second year, the sound, scientific education we are able to give our students is lamentably poor. It is only in the third or fourth year we can specialize with any degree of thoroughness, and personally I feel we should gain a great deal if our student body were such that we could concentrate more thoroughly in the matter of scientific training.

DR. JOHNSON: It has been my fortune and my misfortune to have had a certain amount of academic life, as well as a certain amount of industrial life. I must confess that in the course of industrial work I suffered a great deal of humiliation and do still in my ignorance of what we might call industrial life, that is, the attitude or the difference in attitude which a man has towards industrial and academic work. It seems to me that any college course which can give a fundamental scientific training and at the same time give to the student something of the industrial atmosphere would be extremely valuable.

DR. MACLAURIN: As far as Saskatchewan is concerned we find them very poorly equipped on entrance, and in my opinion the student who has taken chemistry in the high school is the student who does best in the first year in the university.

As far as diminishing the length of time in our institution, the first year we give only one course in chemistry; in the second year we endeavor to give them three courses; then in the third year there is a possibility of them taking three courses. Elementary courses in organic chemistry are not sufficient to prepare a man to do research work in organic chemistry. Nor is an elementary course in physical chemistry sufficient to prepare a man in physical chemistry. It really needs a second course in organic chemistry and a second course in physical chemistry before the man can undertake work in co-ordinated chemistry. For instance, as we know, co-ordinated chemistry is one of the most important phases of chemistry in industrial work, so I would be very sorry to diminish the amount of real, thorough training in the university before starting a man on research problems, because there is not any doubt that that man will get the wrong impression of research work if he starts at it too soon and it is really only after a man works at the research problems for two or three years that he knows whether he is capable of doing high-class research work.

DR. GOODWIN: I might perhaps add a word about the Scotch universities. I remember that the course extended over three years, the B.Sc., and I also remember that the subjects each year were very few. The Scotch curriculum for B.Sc., in my time, was remarkable in that. They attempted very few subjects, but they did them well. In our B.Sc. courses they are pretty much the same in all universities in Canada, so far as I have examined. It seems to me we make the mistake of crowding each year

with too great a variety of subjects, so that even in the fourth year of the course, when I think the student should have got down to his professional subjects and have nothing else to think about but his professional subjects, even in that fourth year you will find this piece of a subject added and that piece of another subject, and the poor student has his mind dissipated by studying six or eight pretty closely related but different subjects at the same time. That, I think, is the fundamental weakness in the B.Sc. courses as we have them in the Canadian universities.

Now, it is just as easy, perhaps more so, to cultivate the character of the student, the balance of his ideas and the appreciation of the fine points of things by the right kind of study of one or two subjects as it is to spread him over a great lot of things.

DR. MACALLUM: The question of getting the proper scientific training for the student and cutting down the requirements in time for him to attain the B.Sc. need not carry with it a certain amount of knowledge of Latin and Greek. The Scotch universities are abolishing the requirements for that. The student can get, now, the Sheffield degree without that, and you will find that in a few years Latin will be obsolete for the Science requirements. As to French and German there are very few students who can read it, even after four years.

DR. RUTTAN: I think perhaps it would be just as well to leave the matter as it stands.

We have had a very interesting and full discussion both with regard to scientific training in abstract science of the students and also the possibility of developing more completely a class of graduates who are able to go directly into works, but not necessarily men who are going to take up research. I think we ought to distinguish between the two, and I think that probably we will bring before you later on this question of the extra education in chemical engineering in Canada. There are a great many difficulties to be met, however, before we get that far.

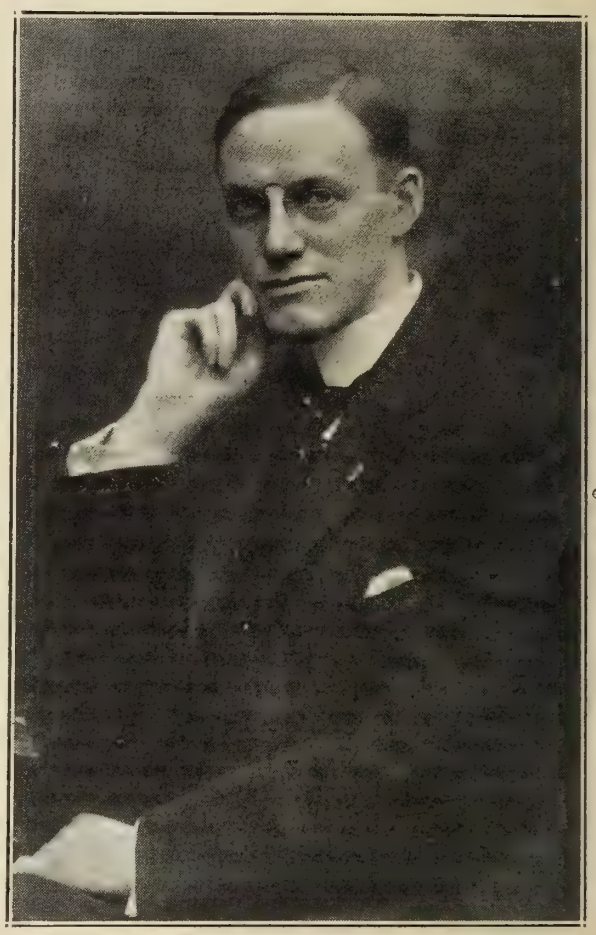
The idea would be to have graduates in chemical engineering of all the universities of Canada take part in this co-operation of the universities, co-operation from the members of the teaching staff, just as Dr. Goodwin has pointed out, and I think it is very important indeed that the men should not be entirely dissociated from the universities when they go into these works, but that they should come back and teach and should spend a certain length of time in the university as lecturer or assistant professor. In other words, that he would learn to put the dollar sign on his chemical equation. He should get that himself, and he should be able to teach the students the value of that from an industrial standpoint.

HAROLD J. ROAST.

AMONG the more prominent of the younger chemists in Canada, Mr. Harold J. Roast ranks high. Like many of our best men, he was born in England, in London, on November 21st, 1882. His early education was obtained at Berkhampstead Grammar School (old Henry VIII foundation). During this period, the movement for the establishment of scientific departments in the old classical schools was just gaining strength. Following this, special studies in chemistry and electricity were undertaken at the City of London College, from which he graduated with the regular diplomas. The various certificates of the Board of Education of the University of South Kensington, etc., were obtained in connection with courses in chemistry and electricity.

He first stepped out into practical work in the essay laboratories of the St. Paul Street works of Johnson & Son (assayers to the Bank of England), becoming, after two years, manager of this department.

Mr. Roast himself can offer no special reason for coming to Canada, which he did in 1902, except the desire to try his fortune in a new land. He came, however, and was temporarily in charge of analytical work under Dr. Hersey in



Harold J. Roast.

Montreal. Later he became chemist to the Canadian Iron Furnace Co., 1903 and 1904; then works manager and chemist to the Canadian Carbonate Co., 1904 and 1906. Following this, and until 1911, he was associated with Dr. J. T. Donald. During this period he devoted particular attention to magnesia products, becoming general manager of the Canadian Magnesite Co., and later general superintendent of the Magnesia Products, Limited, Newark, N.J., the former company mining magnesite and the latter manufacturing light carbonate of magnesia, together with magnesia boiler covering. On the outbreak of the war, he returned to Canada, becoming manager of the testing department of the James Robertson Co., Limited, with particular reference to munitions. Mr. Roast is still with this company and is responsible for the scientific control of their various manufactures.

During all this period an active consulting practice was carried on, in connection with magnesia, carbonic acid gas and metals. At the present time, Mr. Roast is consulting

chemist of the Dominion Engineering and Inspection Co., and the Kingdon Mining, Smelting and Manufacturing Co. He has also had much to do with the designing of magnesia plants abroad.

A connection is still retained with university work. Last year a course in metallography was instituted at McGill, and will be continued this year. In this way his wealth of experience is brought to the assistance of works-managers and chemists from the large industrial plants of Montreal.

During the last several years, micrographic studies of metals and the production of pure ingot metal from waste products, along with the fabrication of alloys for special purposes, has given him his most interesting work. The result has been the development of certain alloys not hitherto manufactured in Canada, and special services have been rendered the explosives department during the war in matters connected with the use of lead linings.

In society affairs connected with his profession, Mr. Roast has been of great assistance, indeed. In 1902 he became a fellow of the Chemical Society of London, England; in 1915 vice-president of the American Institute of Metals. When this institute amalgamated with the American Institute of Mining and Metallurgical Engineers, he became Canadian representative on the executive of the Institute of Metals Division. He holds further executive positions on the Montreal Metallurgical Society and the Society of Chemical Industry, as well as being a member of the Chemists' Club and the American Society for Testing Materials. With all this, he has found some time for the preparation of several papers along the lines of his work.

To the average Canadian chemist, however, Mr. Roast is best known by his great interest in the Canadian Institute of Chemistry and as secretary of this organization. He has been most active in matters relating to the beneficial organization of Canadian chemists, and undoubtedly there are few men who could bring the same amount of continued enthusiastic work to the general advancement of the Institute. This new work is certain to continue his broad connection with the development of chemical industries within the Dominion.

Fifth Exposition of Chemical Industries.

A Full Review of the Exposition Held at Chicago with Detailed Description of Some Exhibits and a Report of Society Meetings Held.

THE Annual Chemical Exposition is now an institution in American industry. For students it has become a special course; for older men a means of refreshing themselves and seeing things in which they have a business interest in using; for the general expansion of trade it is a factor of the greatest magnitude. Whether the location is Chicago, New York or any other large centre, the drawing power of the Exposition is likely to increase year by year. It is such a practical and efficient stock exchange for ideas that attendance is rapidly becoming a most essential part of the year's business.

Surrounding the exhibits it has been possible to build up a chain of inviting side-trips, visits and gatherings of technical societies, such as will induce men from all branches of industry and academic life to make a special effort to be present. The Chemical Bulletin, speaking editorially for the chemists of Chicago and vicinity, has condensed the function of the Exposition to the following terms: "The Chemical Exposition is a medium, a solvent in which the reaction between chemistry and capital may proceed, and the more atoms of chemistry and the more atoms of capital there are present, the greater will be the quantity of the end product—chemical industry."

In former years the war, coupled with the newness of the magnified chemical industries in the United States, tended to detract somewhat from the solidity of the Exposition effect. Now, however, the Exposition appears as it really is, a film of the industrial solidity of the country under peace conditions, and a vision of the paths opening up in the immediate future. It lays bare the foundations upon which our confidence in industrial developments must rest.

Coming to the Exposition from Canada, one is impressed by the interest taken by Americans and others in the rapid development of Canadian resources. It is well recognized that Canada needs only a reasonable increase in population and a fair amount of capital to become a country of great magnitude and importance. In short, it is recognized on all sides that suitable resources await development. The faith of a Canadian in his own country must be increased by the active interest taken by others in questions relating to its development. It can be noted with pleasure that this year an increasing number of agencies in the form of Canadian exhibits were present to focus attention on Canadian possibilities.

No central building was available which was large enough to house all the exhibits. By linking up the Coliseum with an adjacent armory, satisfactory space was obtained. Below will be found a series of short descriptions of a few booths.

Canadian National Railways.

The activities of railways are expanding, and, under the able direction of Mr. C. Price-Green, the Canadian National Railways are becoming known at home and abroad. The placing of an exhibit at Chicago was by way of an experiment, and the results obtained warrant a greater devotion to this field in the future. Surrounding a pyramid, lit up internally, were displayed many Canadian raw products upon which chemical industries have been or may be based. Views of typical industrial scenes were displayed and minerals from various sources. In particular, some remarkable samples of Ontario marble caught the eye. Around the booth were displayed samples of Canadian woods, while in the centre, as part of the main display, were grouped products of wood distillation from plants of the Standard Chemical Co.

Ontario Department of Mines.

As is usual, a display of precious metals always calls for inquiries from visitors. The leading Province of the Dominion, as far as mineral production is concerned, was well represented, and the various minerals shown stimulated an unusual number of inquiries from business men. In particular there was a special demand for information regarding the production of cobalt and nickel salts, and

it would appear that there is still a large field open for production in these lines in Ontario. Samples from various nickel, gold and silver mines and refineries were shown. Mr. Rogers, of the Ontario Department, was in charge.

Shawinigan Chemical Industries.

An exhibit combining the products of the Canada Carbide Co., the Shawinigan Electro Metals Co., and the Canadian Electro Products Co., as well as representing the Shawinigan Water & Power Co., formed a most interesting group. Views were shown of various plants, power stations and falls in the Shawinigan district. Samples of synthetic acetic acid and other organic chemicals produced in this connection were on hand, along with samples of carbide and magnesium products. This latter field contains wonderful possibilities indeed, and should result, in time, in the establishing of a new large electro-chemical industry in the Dominion. A photograph of this exhibit is given here.

Dominion Government Booth.

The water powers of Canada remain a potential resource of the first magnitude, and are continually being investigated by outside capital. Representatives were present from the Mines Branch of the Department of Mines and from the Bureau of Statistics. It is believed that the result of the work done to date at the Chemical Exposition will lead to a participation of the Dominion Government in a larger way at future expositions. It is a real opportunity to display the resources of every province and connect up the capital necessary for full development.

Groch Centrifugal Flotation Co.

This Cobalt company, under the direction of Mr. Groch, who has spent several years in perfecting flotation devices, had one of the most interesting exhibits on the whole floor. In the Groch system the mineral-bearing pulp is aerated by means of centrifugal impellers, each consisting of a hollow vertical shaft and a centrifugal runner. The machine is so arranged that there are no compressors or blowers, and every unit is a complete flotation machine. A new machine of interest to paper mills was shown. In a paper mill about 7% of total stock is lost on the average belt screen. The Groch System attaches minute air bubbles to each fibre and thus floats the stock off. The operation of extraction and return of stock is completed in about six minutes. Where screens are used in series of three the saving will average about 50%, it is claimed that by flotation a saving of 90% can be obtained at a cost of less than 20 h.p. per 1,000 gallons per minute. There is an advantage in colored stock, where it can be returned to the same machine, avoiding a loss in clearing up to change colors.

Maurice A. Knight Co.

A display of large pieces of acid-proof stoneware for the handling of practically all acids was presented. Among the interesting pieces were a No. 3 inverted Cellarius Tourill as well as a No. 1 and No. 2 of upright design; open and wet types of tower disributors and suction filters; 160-gallon blow-case and large nitric receiver; types of laboratory sinks; connecting pipes, pulsometers, monkey pumps and valves. Everything shown was of the completely vitrified type.

Nassau Valve & Pump Co.

They exhibited acid-proof pump in operation, capacity 125 gallons per minute; full line of chemetal valves.

Lead-Lined Iron Pipe Co.

The general practice of lining iron pipes with lead has been found so economical in the end that business in these lines has greatly expanded wherever hot and cold water or acids and corrosive liquors are to be handled. This company displayed products in their line, showing a very high degree of workmanship and care.

United Lined Tube & Valve Co.

Lead-lined pipe, tube and valves. The Hoyt Metal Co. of Toronto are Canadian agents, and were in this way represented at the Exposition. These products are meeting with greater favor every day, as they fill both exceptional and ordinary conditions with satisfaction.

General Ceramics Co.

The feature of this exhibit was the display of small models of larger stoneware apparatus. These were exact duplicates of all standard types manufactured. They could be readily demonstrated, and gave very good impressions. A model nitric acid plant was the distinctive attraction.

J. P. Devine Co.

Autoclaves, carbonators and kettles were shown. Also two special motor-driven pumps in connection with small drying chambers demonstrated features of larger apparatus manufactured by the company. A most interesting grinding and pulverizing mill was exhibited by the Kek Manufacturing Company in connection with the Devine Company.

Dorr Company.

A demonstration was given on a semi-commercial scale of the working of the Dorr thickener and classifier on the separation and dewatering of products of different characteristic properties.

Crane Packing Co.

Some remarkable flexible metallic packing for acids; also gaskets used in chemical industries.

Pfaudler Company.

A full display of well-known glass-lined steel equipment.

Mojonnier Brothers.

Some new lines of chemical apparatus developed from machinery used in dairy industries. Drying chambers, vacuum pumps, viscosimeters, extraction flasks and type glassware.

Valley Iron Works.

The commercial apparatus of the firm was represented by laboratory autoclaves built to demonstrate larger sizes.

The Widney Company.

The Widney "Modulimeter," permitting a standard measurement of normal thickness and relative hardness, is an instrument of value to felt, rubber, textile and paper manufacturers.

Buffalo Foundry & Machine Co.

"Buflovak" and "Buflokast" apparatus occupied the available space at one end of the Coliseum, and the large pieces on display were thoroughly studied by every one.

This well-known and well-made apparatus has such a wide application in industry that an exposition without some of the familiar pieces would be hard to conceive of.

Sowers Manufacturing Co.

350- and 150-gallon Standard Dopp Kettles. A 10-gallon standard Dopp seamless cast-iron vacuum pan, equipped with style J sweep mixer, outlet, hand and peep-holes. A sawed section of a five-gallon Dopp kettle demonstrated the casting of kettle jacket and stay bolts in one piece.

Monsanto Chemical Works.

A most complete line of pharmaceutical chemicals with technical and heavy acids. This company is now making phthalic anhydride, which was previously made in quantity

only in Germany and Austria. Another new set of products for America are the Dakin antiseptics.

National Aniline & Chemical Co.

A complete display of coal-tar dyestuffs, intermediates and food colors. Over 200 distinct dyes were shown, all of American manufacture. The past year has brought out many new colors.

Sunbeam Chemical Co.

This company also displayed a number of special intermediates and colors, as well as sulphonated oils.

Anaconda Copper Co.

Illustrating the production of copper, zinc and lead by most modern practice from the ore to a variety of finished products.

Semet-Solvay Co.

Working models provided interest in this booth. Various uses of coke, ammonia sulphate and caustic soda were demonstrated.

Newark Wire Cloth Co.

Some very interesting fine grades of these products were shown, and the advances in manufacture during the war could be readily traced. There was every evidence that in this particular American production was not behind.

Raymond Bros. Impact Pulverizer Co.

Operating models of rolling mills and pulverizers equipped with air separators formed the display. The diversity of application was well shown.

Swenson Evaporator Co.

Modern evaporating machinery suitable to plants having large scale evaporation problems. Most modern systems were shown.

Jewell Polar Co.

The feature was a water-distilling apparatus suitable for plant installation. Steam, gas and electric stills are made.

Merck & Co.

Special chemicals were shown—chloralhydrate, carbolic acid, salicylates, hydroquinine, acetphenetidin, phenol and sulphonates.

Wm. Garrigue & Co.

A firm of chemical engineers specializing in oils and fats, showing various products at different stages in processes.

General Electric Co.

A model for the illustration of the Cottrell process of precipitation was exhibited. A 100,000-volt Kenetron with filament-heating transformer was in operation.

H. Reeve Angel & Co., Inc.

Exhibits of laboratory apparatus, all grades of filter paper and filtering materials, showing recent advances in production.

The general business of producing laboratory apparatus has so expanded in the United States during the last four years that it is now possible to show a diversity of equipment all made in America more than equal to any previous imported displays. Many firms were represented, and every one of them had continual crowds of interested visitors.

Eimer & Amend.

All the glass and chemicals, and most of the instruments shown, were made by the firm in what has become the largest glass factory in the world. Bureau of Standards glassware is now readily obtainable. A variety of special instruments, all taken from stock, illustrated the magnitude of the service offered. Practically all those known to chemists were on hand. This all-American firm announces a business done with the United States Government of over $3,000,000 at a time when supplies were most urgently needed.

Scientific Materials Co.

A full line of general apparatus illustrating the possibilities of the immediate complete equipment of industrial or educational laboratories of all kinds. Special glass apparatus and microscopes were shown.

A. Daigger & Co.

This booth was designed to illustrate a few special chemicals and types of apparatus rather than a large amount of ordinary equipment. Two interesting pieces were an apparatus for experimental work on the hydrogenation of oils, and a rather simply designed but quite "fool-proof" coal sampler. The house carries a full line of laboratory supplies.

E. H. Sargent & Co.

All glassware shown was exhibited as in use and some very excellent arrangements were made. Various operations and common instruments were shown as they would be used. An exhibit of Munktell's filter paper formed an imposing central pyramid.

Central Scientific Co.

The feature of this exhibit was a demonstration of the manufacture of various glass articles. A very large stock of apparatus was displayed. Many pieces of special design were also shown, and every evidence was given that the needs of the modern laboratory could be fully and promptly supplied.

Meetings of Societies.

Several societies met during the week. Among these were the American Electro-Chemical Society, the American Ceramic Society, American Institute of Mining and Metallurgical Engineers, the Technical Association of the Pulp and Paper Industry, the American Steel Treaters' Society. For these various gatherings dozens, if not hundreds, of papers had been prepared, more or less grouped around a few main topics picked out as likely to be of special interest to the members of the particular societies. The American Electro-Chemical Society brought forward their semi-annual series of reports, and more than a dozen good reports of work done were presented. Besides a series of general papers, general subjects were discussed. On Wednesday "Ferrous and Nonferrous Metallurgy" was the topic. Papers on various uses of the electric furnace were given. On Friday the general subject of Catalysis was handled by Prof. H. S. Taylor, of Princeton. Various conceptions of contact catalysis and various explanations were put up with evidence. The thermal problem, as related to catalysis, formed the latter part of this discussion. The last series of papers heard by the Society dealt with the "Manufacture of Fluorine," given by F. C. Mathers; "Factors Governing the Structure of Electrodeposited Metals, by William Blum; and "Possibilities in the Electro-Chemical Production of Organic Compounds."

Meeting of Ceramic Society.

This Society was founded in 1899, and now has eleven hundred members. It publishes its own journal, and embraces the departments of industrial chemistry and scientific manufacture in which silicate rocks and nonmetallic minerals are wrought and made permanent by fire. Papers presented were: "Superior Refractories," by R. C. Purdy; "The Making of Pottery," by T. H. Rhead; "General Types of Optical Glass," by R. J. Montgomery; "Brick and Tile," by D. F. Stevens; "The Application of

Scientific Methods to Ceramic Research," by D. V. Bleininger; and "The Manufacture of Optical Glass," by J. C. Hostetter.

Mining and Metallurgical Engineers.

Strike conditions at Gary, Indiana, destroyed a portion of the prepared program, but several well-attended meetings were held at the Congress Hotel. A very large number of papers were presented on a variety of subjects. The program was interspersed with trips to local and surrounding points of interest. Zinc smelters and coal mines at De Pue, Ill., and oil refineries at Whiting, Indiana, were visited. Sessions or groups of papers were presented under the following general heads: (1) Non-Ferrous Metallurgy and Metallography, (2) Coal and Gas, (3) Geology, (4) Milling, (5) Industrial Organization, (6) Oil, (7) Iron and Steel, (8) Sulphur in Coal, (9) Pyrometry (some sixty papers were presented on this latter subject alone).

Pulp and Paper Association.

All the standard branches of the work came up for discussion, including standard methods of testing materials.

Booth of Shawinigan Water & Power Co. at National Exposition of Chemical Industries, Chicago.

A visit was made to the paper-mill plant of Sears, Roebuck & Co., where a luncheon was given by the firm. The Forest Products Laboratory at Madison, Wis., was also visited. On Thursday a smoker and entertainment was held at the Union League Club.

Society of American Steel Treaters.

Their program called for addresses, visits, papers and discussions, and a most delightful combination was worked out. Prominent men in the Society were present from various points and handled the different sessions. Presiding officers were: T. E. Barker, H. H. Clarke, Chicago; G. W. Esau, Milwaukee; David Bell, Buffalo; B. F. Weston, Pittsburg; G. W. Pressell, Philadelphia; W. S. Bidle, Cleveland, and F. P. Fahy, New York.

General Sessions.

Besides papers from societies a series of meetings were held during the week, at which a number of general, but important, papers were given. On Monday the Exposition was officially opened, with addresses of welcome by State officials. On Tuesday papers were presented on "The Manufacture of Laboratory Supplies and Porcelain." Representatives from well-known firms described advances and practice in manufacture of glassware. On Thursday the work of the National Research Council of the United States was reviewed by Dr. H. E. Howe. It was pointed out that co-operation in industrial research was necessary, and a more active attitude taken in a national way toward these problems.

Mr. C. Price-Green, the Industrial Commissioner of the Canadian National Railways, pointed out in a short address the needs of Canada in men and money, as well as the striking opportunities for the development of industries based on the resources of various provinces.

The Motion-Picture Program.

This is certainly a growing attraction where technical men gather together. The number of reels shown this year shows a marked increase. The story of the history and utilization of coal was thus told by the United States Bureau of Mines and the Koppers Co. The operation of types of electric furnaces was shown. Views of Shawinigan industries were given by the Shawinigan Water & Power Co. The Bray Studios contributed special films under such heads as "Chemistry in Munitions" and "The Invisible Phases of Crystallation." Views of Canadian points were shown by the Canadian National Railways. A large number of films illustrating manufacturing processes were given on Saturday.

These are entertaining features of such an exposition, and while the application of films to descriptions of industrial operations is yet only beginning, it is more than likely that these films will form a regular part of future courses of study at universities. A general knowledge is most readily obtained in this manner.

The Willard Gibbs Banquet.

One of the most pleasing events of the whole week was the annual banquet held to do honor to one of the lead-

ing men of science in America. Professor William Albert Noyes, head of the department of chemistry and director of the chemical laboratories of the University of Illinois, was present to receive the award of merit.

Professor Noyes has published many papers covering a vast amount of research work. He considers his work on the atomic weights of hydrogen and chlorine, on molecular rearrangements, on camphoric acid, and on compounds containing positive chlorine, as his most important works. His field has been very broad, including work on the oxidation of benzene derivatives, and the determination of sulphur, and manganese in iron, as well as such fields as the hydrolysis of maltose and dextrine.

As an author he is best known by his text-books on organic chemistry and qualitative analysis. His work for the Americal Chemical Society has been of the greatest importance. He was secretary from 1903-1917, and editor of the Journal from 1907 to 1917. In 1907 he organized and edited "Chemical Abstracts," continuing until 1909. In recent years he has devoted much time and thought to

Exhibit of acid-proof stoneware shown by Maurice A. Knight at National Exposition of Chemical Industries, Chicago.

problems relating to electronic theories of valence and atomic structure. Professor Noyes took as his subject, "Positive and Negative Valences," and gave a most comprehensive survey of his subject. Dr. L. V. Redman, chairman of the Chicago section, acted as toast-master, and informal remarks were made by Dr. W. E. Stone, of Purdue University; Dr. Harry Judson, of Chicago; Dr. David Kinley, of Illinois, and Dr. Julius Stieglitz.

Future Prospects.

Everything would indicate that future expositions will be held at least annually. It has already been decided to hold the next one in New York in September, 1920. Many firms have become practically permanent exhibitors, and their number is increasing. Many contracts for space are already closed.

This year Canada was represented in a way which should only be considered as a beginning. It is expected that the Dominion Government will greatly enlarge the effort made. During the war it was hardly possible to attend to such matters, but from the present it should be the first business of the country to bring in capital and the right kind of intensive development for our industries. These possibilities cannot be brought to the front by any better single means than by a more active participation in such events as the Chemical Exposition Here not only can direct contact be made with capital, but also with the technical men of vision, who are the eyes of progress.

Behind the Footlights.

It would be an unfortunate shame if not only those who came to see the Exposition, but those who read about it, were not taken by the hand and shown some of the inner, less obvious, things relating to the production of such an exhibit. Those who were exhibitors themselves were much more appreciative of the displays of others than anyone else. They understand the heartbreaking incidents of the weeks before and the after-toil.

Every possible combination of annoyance bears down upon the poor exhibitor. The delightful (!) delays and congestion of express; the innumerable possibilities for exasperating situations arising from customs regulations; the helplessness of well-wishing customs brokers; the high percentage of breakages in delicate instruments and those not so delicate; the uncertainty of special and hurry-up orders between offices and factories—all these are but preliminary proceedings to the battle-royal.

Having arrived by these various approaches to the Coliseum an unwritten language alone suffices to describe the nature of events. Even those who are old at the game are continually being presented with noval difficulties. Of late perhaps the greatest of these arises from the special attention given such exhibits by the labor unions. Labor is absolutely king. The general manager of the biggest corporation on earth has no more influence than a whiff of smoke. International unions for all purposes prey upon

him when he is down; walking delegates gloat upon his inability to avoid their commands.

It has been been written in the book and well advertised, that if even so much as a stain is placed upon a piece of wood by uniniated hands even so there will be no show.

There must not be a single offender of labor in all this gathering. After carefully wiring his special apparatus in his own plant, and after many tribulations, he is about to connect it with the local terminals, he is informed in a kindly but decisive voice that so far shall he go but no farther until a properly qualified man has unwound the work and christened it by the hands of local labor.

For those absolutely unfamiliar with these modern distinctions, a typical case in detail will not be out of order. The problem is to raise a piece of machinery weighing 700 pounds a distance of four feet and place it on a supporting stand. If it is undertaken to do this by main strength and awkwardness no one seems to mind, but if it is decided to apply the principle of the block and tackle a situation arises which once again can only be solved properly in the eyes of labor by certain individuals who are willing to do this operation at a stated price. Woe is the exhibitor who attempts this work for himself and by himself.

Likewise is he who paints his own kettle or can or whatever trivial thing it may be in the greatest danger of sudden extermination. These are the prerogatives of modern labor as applied to special situations at a very critical period in their brief life. While we do not wish to quarrel here with the rights of any class of manual or mental laborers, it is hardly amusing to note the absurdities of a situation wherein the labor of one man's hands, in one part of the country, must be destroyed before another man of no greater knowledge or efficiency will continue the work.

These are some of the things which the men who greet you smiling from their booths carry away with them as food for thought sufficient to last them no small time.

SUMMARY OF PAPERS PRESENTED TO THIRTY-SIXTH GENERAL MEETING OF AMERICAN ELECTRO-CHEMICAL SOCIETY, CHICAGO, SEPTEMBER 23-26, 1919.

"The Activation of Carbon," by N. K. Chaney.

"Activated carbon" is a war-product, originated as a means of defence against toxic gases, and is now finding industrial applications. A general theory has been formed that elementary carbon other than diamond and graphite exists in two modifications, "active" and "inactive," or alpha and beta. A second consideration is that all "primary" amorphous carbon consists essentially of a stabilized complex of hydrocarbons, adsorbed on a base of "active" or alpha carbon. These primary postulates were discussed.

"The Effect of Amalgamation Upon the Single Potential of Aluminium," by L. Kohlenberg and J. A. Montgomery.

Measuring the single potential of aluminium in a one-third molar solution of aluminium chloride at room temperature, by means of the calomel electrode, the writers obtained much higher values with amalgamated aluminium than with unamalgamated aluminium, due to the removal of the coat of resistant oxide by the mercury. They showed also that the measurements were actually the single potentials of the aluminium and not those of an aluminium amalgam.

"The Penetration of Iron by Hydrogen," by T. S. Fuller.

The results are given of experiments showing the effect of various conditions on the penetration of iron by nascent hydrogen at temperatures from 20° to 100° C. Hydrogen was generated on the outside of an iron tube by immersing the tube in a solution, and the volume of gas penetrating to the inside of the tube was measured. The rate was greater for a unit immersed without electrical connections than when the unit was used as a cathode, but in the latter case the greater the current the greater the penetration. The rate also increases with the temperature. Copper is not penetrated, but a coating of tin on the iron increases the rate.

"A Square Deal for the Electric Furnace," by W. G. Weidenthal.

A polemic defending the electric furnace for steel-making against prejudices of the trade. The user is urged to acquaint himself thoroughly with electric furnace practice and furnish the best that can be produced by the electric furnace.

"Lead-Plating from Fluoborate Solutions," by W. Blum, F. J. Liscomb, Zalin Jencks and W. E. Bailey.

A most comprehensive paper covering the general principles of fluoborate solutions, and describing in detail methods used and results obtained in plating lead. In general, it is concluded that lead-plating is a very practical operation, which can be conducted by any experienced plater with the usual facilities. The future application is broad.

"Factors Governing the Structure of Electro-Deposited Metals," by W. Blum.

A series of experiments, involving changes in current density, concentration, agitation, temperature, conductivity, metal-ion concentration, with some recommendations regarding the composition of solutions, choice of metal salts, and the making of additions to solutions in general.

"The Effect of Amalgamation Upon the Single Potentials of the Binary Alloys of Aluminium with Copper, Zinc and Nickel," by L. Kohlenberg and J. A. Montgomery.

"Depreciation of Small Dry-Cells With Age," by A. J. Helfrecht.

The author endeavors to show how closely the method of judging cell deterioriation, called "flash-test," approaches actual measurements of capacity through discharging the cells. Comparative curves for the different sizes of cells tested are given. From the data gained a table, indicating reasonable depreciation of four important sizes of small cells, has been obtained.

"Some Problems in Contact Catalysis," by Wilder D. Bancroft.

A few special cases where further work might lead to a better general theory are taken up. Cases where a reaction stops progressing without apparently reaching equilibrium were quoted. The reaction given was that between phosgene and water.

WATERWORKS SYSTEM PLANNED.

A waterworks system for Scarboro' township, York county, Ont., is being planned, including filters, intake, etc. Estimated cost, $100,000. E. A. James, 57 Adelaide Street East, Toronto, engineer.

PERSONALS

The city of Toronto at the end of the present year will lose one of its ablest officials in the person of Colonel Dr. George C. Nasmith, Director of the Laboratories of the City Health Department. Dr. Nasmith has tendered his resignation, and will become connected with a new concern, Gore, Nasmith & Storey, consulting public health engineers, of Toronto, where he will be able to devote all his energies to research work touching upon all matters of public health.

During his association with the Health Department Dr. Nasmith successfully inaugurated many improvements for the benefit of the citizens, not the least being the regulations for improving the water supply, which resulted in Toronto having the purest water of any city on the continent. He also brought about reforms in regard to milk supply and the supervision of dairies. At the outbreak of the war the services of Dr. Nasmith were requisitioned by General Sir Sam Hughes, then Minister of Militia, and he supervised the installation of the water supply and the sanitation of Valcartier Camp. He afterwards proceeded to England with the Canadian forces and did valuable work at Salisbury Plains and other points. His greatest work, however, was in France and Flanders. He was present at the second battle of Ypres, when the Germans made their first gas attack, and he invented a gas mask for the use of the troops when combating similar attacks later. For this and other most valuable scientific work, Dr. Nasmith was honored by his Majesty King George, who conferred upon him the Order of St. Michael and St. George. Dr. Nasmith is an author of some repute, and has just completed for publication a historical review of the earlier stages of the war, under the title, "Canada's Sons and Great Britain in the World-War."

Lieut. E. H. Joliffe has been appointed head of the Department of Chemistry, Toronto Technical School. Mr. F. H. Carter has been made assistant in the same department.

After three years' absence on military service, Dr. A. Grant Fleming, analyst in the laboratories of the Toronto Health Department, has returned to his duties. Dr. Fleming was medical officer to the 4th Battalion in France during the German offensive of March, 1918, and the later advance of our armies to Mons. He left the front a week after the signing of the armistice. Dr. Fleming was recalled from England by Dr. Hastings to take charge of the city's laboratories, in place of Dr. Adams, who was recently appointed health officer for the border district at Windsor.

It is with deep regret that we chronicle the death of Mr. W. Cromwell Gurney, president and general manager of the Gurney Foundry Company of Toronto. The late Mr. Gurney, who died suddenly fro mheart trouble while visiting the office of his physician, was very prominent and well known among the business men of Eastern Canada.

A party of six English cotton manufacturers, who are touring this continent for the purpose of making a study of industrial conditions, visited Toronto recently. While here they were the guests of Mr. J. B. Ganong, president of Lever Bros. They will visit all the principal Canadian and American cities before returning to England this month.

Mr. W. H. Clarkson and Mr. H. D. Cameron, after three years' service in France with the Canadian Expeditionary Force, have returned home and have resumed their positions on the office staff of the Nichols Chemical Company, Toronto.

Mr. R. E. Hore, who, since June, 1913, has been editor of the Canadian Mining Journal, has retired from that position to take up professional consulting practice.

Mr. A. C. Wheatley, formerly with the Parry Sound Iron Co., Parry Sound, Ont., has been appointed to the staff of the Department of Chemistry of the Ontario Agricultural College, at Guelph, Ont.

OBITUARY

The death occurred at Owen Sound, Ont., of Mr. A. H. Brown, Inspector of Mines. His passing has caused deep regret, particularly among the mining fraternity, where he was well known and respected. Until 1903 he was assistant chemist and assayer at Deloro, Ont., also in charge of the bromo-cyanide plant for the Deloro Smelting & Refining Co. From 1903 to 1905 he had charge of the 40-stamp mill and cyanide mill and cyanide annex for the Daly Reduction Co. at Hedley, B.C. Following this he was prospecting in the Cobalt district for two years, and took two years' preliminary work on erection of cyanide plants. He superintended the installation of an experimental plant to treat arsenical gold ore for the Canadian Exploration Co. at Naughton, Ont. From July to December, 1911, he was manager of the Pike Lake Mines, Swastika, and in 1912 accepted the position of manager of the Hudson Bay Mines. From January, 1914, to April, 1916, he was manager of the Dome Lake Mining & Milling Co., South Porcupine, and in 1917 was manager of the Green-Meehan Mine. He has been connected with the Department of Lands, Forests and Mines since the beginning of the present year.

BOOK REVIEWS

The Condensed Chemical Dictionary.

Edited by F. M. Turner, Junior, and Associates. Published by the Chemical Catalog Co., Inc., New York, pp. 525. Price, $5; flexible leather, $6.

This book belongs to a new type. It has broken new ground and at once impresses you with its value. There are many men in business who have not had special training in chemistry, and who from their work are often called upon to know definite facts relating to the properties of a number of chemical products. Even among chemists and those who profess to know, there often exists a very great lack of knowledge regarding the simple properties of many commercial products. One may know the formula and yet not recognize the substance on sight or have any idea of its relative commercial importance or uses.

Substances are treated under such heads as: (1) Color and properties, (2) Constants, (3) Solubility, (4) Derivation, (5) Method of Purification, (6) Grades, (7) Containers, (8) Uses, (9) Fire Hazard, (10) Shipping Regulations.

To exporters and importers, brokers and jobbers, financial houses, lawyers, librarians, purchasing agents and chemists themselves this book can be of very great value indeed. It is infinitely more suitable as a ready commercial reference than anything yet produced in the field it covers.

In size and arrangement the book lends itself to ready service, and is one of those practical efforts which, when accomplished, shows its value to be obvious.—L. E. W.

INDUSTRIAL SECTION

Construction, Manufacturing and Market News

Alberta.

Redcliff.—The Dominion Glass Co. has completed plans for the erection of two large additions to their plant.

British Columbia.

Beaver Cove.—An addition is planned to the plant of the Beaver Cove Lumber & Pulp Co.

Collingwood.—The Gregory Tire & Rubber Co. will erect a plant near Kingsway. It is expected that the plant will employ approximately fifty men and will have an output of 300 tires and 600 inner tubes per day.

New Westminster.—The Western Cordage Co. has definitely decided to locate a plant in New Westminster, a site having been secured near Sapperton in the industrial area. The machinery has been ordered, and when completed the plant will employ eighty to ninety returned men. The industry will be a co-operative concern, organized under the provincial government's industrial development scheme.

Vancouver.—Six hundred thousand dollars will be expended by the Imperial Oil Company on improvements to their plant at Ioco, Burrard Inlet. The work will be commenced this fall, and 250 men will be engaged. The "still" capacity of the Ioco plant will be doubled by the improvements.

A group of local business men, headed by Gordon Jonah, of the Jonah-Piat Co., have formed a company and will erect a woollen mill.

T. H. Laslett will construct a new brick factory at 721 Seymour Street. Estimated cost, $10,000.

Manitoba.

Winnipeg.—It is rumored here that what will be the largest hydro-electric power plant in the world will be constructed at Little du Bonnet Falls to the northeast of the city. An expenditure of nine million dollars is involved, and 160,000 h.p. will be developed continuously.

The Twin City Separator Co., manufacturers of the Bulldog fanning mills, are at present constructing a three-story brick machine shop and warehouse building.

Additions to their lime plant are being made by the Manitoba Gypsum Co.

The Continental Oil Co., which has operated plants at Winnipeg, Regina, Saskatoon, Calgary, Lethbridge and other western points, has been taken over by a new firm, the North Star Oil and Refining Co., Ltd. The head office will be at Winnipeg.

New Brunswick.

Marysville.—Plans of the big dam which is to be constructed on the Nashwaak River, near Marysville, N.B., by the Nashwaak Pulp & Paper Co., of which Hon. N. M. Jones is general manager, have been filed with the Lieut.-Governor of the province in accordance with the provisions of the act passed at the last session of the New Brunswick Legislature. It is understood that the Nashwaak Co. will proceed with the erection of their big sulphite pulp plant at Marysville in the near future, and will eventually remove the present plant from St. John to Marysville.

Nova Scotia.

Sydney.—A large new barking drum is being installed at the plant of the Cape Breton Pulp & Paper Co. Gangs of men are at work taking out large quantities of pulp wood and making roads in order to facilitate the movements of the motor trucks, which will deliver the product to the pulp mill. Shipments of pulp have been made by steamer to several points in the United States, and it is the intention of the directors to erect eventually a paper mill, which will convert the raw material into the finished product.

The Sydney Foundry & Machine Co., of Sydney, N.S., who conduct a large repair business in marine lines, are applying for a site upon which to build a dry-dock for this port.

Ontario.

Belleville.—A proposition to build a large steel plant in Belleville is now under consideration by the Tivani Steel Co., Ltd. The plant would consist of electric furnaces, rolling mills, merchant bar mills and open-hearth furnaces. A similar plant is being considered for Vancouver.

Brantford.—C. H. Hyman & Co., London, tanners, have let a contract for a $125,000 four-story reinforced concrete canning factory.

Additions to two buildings will be made by the Cockshutt Plow Co., Ltd., at a cost of $24,500. Additions to plant are also being made by the Brantford Roofing Co.

Alterations and extension to office building are being made by the Dominion Steel Products Co., Ltd.

The Robbins & Myers Co., of Springfield, Ohio, will erect a factory here.

The United Portland Cement Co., Ltd., propose to erect a factory at Lafayette, Ont.

Contracts have been let for addition to factory and dye-house of the Slingsby Manufacturing Co., Ltd., and to the factory of the Brantford Computing Scale Co., Ltd.

Bridgeburg.—Engineers have completed survey work on the new Hydro-Electric radial line from Port Colborne to Bridgeburg.

Brockville.—The Brockville Paper Manufacturing Co. will erect a three-story factory on Park Street. Estimated cost, approximately $100,000.

A smelter may be built here by the Consolidated Iron and Steel Corporation, Ltd., 20 King Street East, Toronto, recently incorporated with a capital of $8,000,000, and backed by Toronto and Detroit interests.

Collingwood.—An amalgamation has been made with the Collingwood, Ont., steel plant and the Canadian Western Steel Co., Ltd., with rolling mills at two western points. The new firm has been incorporated in the name of the Canadian Western Steel Corporation, Ltd., and it is proposed to start the idle rolling mills at Collingwood, and also start up the open-hearth furnaces. Construction will begin within a few weeks. This new corporation will have in operation before long three rolling mills, located at Collingwood, Ont., Medicine Hat and Redcliff, Alberta, also a

bolt and nut factory at Medicine Hat, which, it is said, will enable them to supply the trade, both east and west.

Cornwall.—The Firestone Tire & Rubber Co., Akron, Ohio, may erect a Canadian branch here.

Fort William.—The Kakabeka Falls Brewing Co. are extending their present buildings to accommodate an additional bottling plant.

Galt.—It is stated that a tin-smelting plant is to be located at Galt. The idea is to build one smelter to begin with, to be followed by others as the need arises.

The plant of the Victoria Wheel Works is being equipped to manufacture shafts, poles and all bent goods required for carriage making.

The Convertible Tractor Corporation of St. Paul, Minn., may erect a Canadian branch at Goderich.

Goderich.—Some of the men connected with the Lake Huron Steel Corporation that will erect a large plant here are: J. J. Mahon, Newark; J. W. Durfee, Pittsburg; Charles R. Talbot, Detroit; J. C. Jones, Cleveland; Harry S. Hall, Detroit; Stuart A. Howard, Detroit; Allan Warren, Cleveland; C. F. Megow, St. Paul; Bert H. McCreath, Toronto.

Guelph.—The International Malleable Iron Company of Guelph have called for tenders for the construction of a new machine shop and warehouse. The building will be one story in height and will be 189 feet by 120 feet, of concrete and brick, and will cost about $33,000.

The Partridge Rubber Co. is making a $45,000 addition to their plant.

A permit has been granted to the Northern Rubber Co. for a new $100,000 factory building.

Hamilton.—A $600,000 plant will be erected here by Porritts & Spencer, Ltd., Bury, England.

The Dominion Canners have purchased new office premises in Hamilton. They have bought the old Bell Telephone building on Hughson Street, the price being reported to be over $50,000.

Contracts have been let for a $16,000 warehouse for Canadian Cotton Co.; a $10,000 boiler house for Chipman Holton Knitting Co., and a $10,000 warehouse for Canadian Steel & Wire Goods Co.

Kapuskasing.—It is expected that work will shortly be started on the new pulp and paper mill of the Spruce Falls Pulp & Paper Co., which will be erected at Kapuskasing, Ont. The capacity of the plant will be 200 tons a day.

Kitchener.—The Komavar Chemical Co., Cleveland, Ohio, contemplate establishing a Canadian factory. It is stated that a site may be chosen in Kitchener or in London.

Leamington.—Essex County, especially Leamington district, is beginning to rank high as the centre of the tobacco-growing industry of Canada. The crop for all Ontario this year is estimated at 15,000,000 pounds.

London.—The London Concrete Machinery Co. is building a $5,000 addition to its factory.

Morrisburg.—Handley-Page, Ltd., have secured a Dominion charter to engage in a general aeroplane business in Canada. The capital stock will be $2,500,000, and the head offices of the company will be at Morrisburg, Ont. The directors named are William Harold and Admiral Mark Kerr, London, Eng.; Harry Clark, Montreal; Fred Chalmers and W. H. Gannon, of Morrisburg.

Niagara Falls.—The "lower" bridge over the Niagara River is undergoing extensive repairs to the amount of $200,000. The wooden joists are all being replaced by steel girders, and new floors of steel are being laid on the upper section or railway floor of the bridge. Paint to the amount of 1,700 gallons has been ordered to paint the whole structure.

A factory is being erected by the Spring Water Bottling Co., Ferry Street.

Oshawa.—Contract has been let for a factory building to cost $100,000 by the Gananoque Spring & Axle Co.

Preston.—A new factory will be erected here by Otto Homuth, manufacturer of wool-stock.

St. Catharines.—A site for a new collegiate institute has been secured, bounded by Geneva Street, Russell Avenue, Connaught Street and Wolseley Avenue, at a purchase price of $26,100. Building operations are expected to commence next spring, the new building to cost between $180,000 and $200,000. The present collegiate will be sold.

A Canadian company, a consolidation of Canadian interests of P. R. Mallory & Co., Inc., Liberty Electric Corporation and Abendoreth Co., all of Port Chester, N.Y., and P. G. Nichoff & Co., Chicago, has leased the factory in St. Catharines operated in war-time as a munition plant by the company known as the St. Catharines Machinery, Ltd. Tungsten products will be turned out by the new company.

St. Thomas.—A powdered milk factory will locate in St. Thomas, according to an announcement by the Board of Trade of that city. Contracts calling for delivery of 200,000 pounds of milk have been signed, and a production of 25,000 pounds of powdered milk will be the initial capacity of the plant. The points of shipment will be between Simcoe, in Norfolk county, on the east, and Windsor on the west.

The F. J. Harding Co. are reported to be contemplating additions to their plant.

Strathroy.—The Dominion Canners, Ltd., have let the contract for a $60,000 plant here.

Toronto.—An addition, costing about $16,000, will be made to the factory of J. J. McLaughlin, Ltd., manufacturers of bottling and ice-cream machinery, etc.

A $60,000 factory building is being erected by Jos. Simpson & Sons, Ltd., manufacturers of underwear and knitted goods.

The Standard Soap Company, with Mr. H. M. Marshack, manager and part owner, have opened a plant at 40 Dovercourt Road, and are manufacturing a full line of textile soaps. The present capacity of the plant is two and a half million pounds per year with room for enlargement.

An addition will be made to the foundry of the Wm. & J. G. Greey Co., 16 Church Street.

A tannery building will be erected by H. B. Johnston & Co., 774 Dundas Street East.

Canadian Tank & Pump Co., Ltd., capital $50,000, head office, Toronto, Ont., plans to manufacture and deal in self-measuring oil pumps, tanks and storage systems.

Walkerville.—The General Motors Company, now building here, will spend between two and three million dollars on equipment.

Wallaceburg.—A small extension is being made to the plant of the Dominion Glass Co.

Welland.—A new steel industry is in prospect for Welland, a representative of an American concern, engaged in the manufacture of parts for railway and trolley cars, having visited here, and it is understood a suitable site has been found.

Woodstock.—The Canadian Linderman Co. of this city is about to resume manufacturing operations. Beginning this month they will start manufacturing in the local

plant, which has been undergoing extensive repairs of late, a unit electric-lighting and power system, on which it is understood the company has purchased full patent rights. During the war the company was manufacturing shells.

Quebec.

Longue Pointe.—General contract has been let for two factory buildings for the Montreal Locomotive Works, Ltd.

Montreal.—Contracts have been let for four buildings at a cost of $455,000 by the National Breweries, Ltd. A $44,000 factory will also be erected by the United Shoe Machinery Co.

Quebec.—The Rock City Tobacco Co. are making a $20,000 addition to their factory.

Rigaud.—Burnett & Crampton are planning a new foundry, capable of turning out 250 tons of castings a month. They will install molding machines and equipment of the most modern type for producing machinery castings, mill and mining equipment and general castings.

St. Johns.—Belding-Paul-Corticelli, Ltd., have awarded a contract to Anglin-Norcross, Ltd., for the erection of a dye-house. Cost of construction will be about $75,000.

Three Rivers.—It is announced that work will start at once for a sulphite mill, grinding mill and three workshops costing $500,000, for the International Paper Co.

Plans are in preparation for the erection of an $8,000 factory for the Frisco Bottling Works Co.

Canada Iron Foundries, Ltd., are erecting an $18,000 bath building.

Saskatchewan.

Regina.—The Goodyear Tire & Rubber Co. has announced its intention of building a $75,000 block here at once to serve as western headquarters.

A warehouse will be erected here by the British-American Paint Co.

Young-Thomas Soap Co. will rebuild part of factory destroyed by fire, at cost of $5,000.

The Sanitary Buildings, Ltd., contemplate construction of a warehouse and factory at corner of Scarth and Sixth Street. Estimated cost, $25,000.

Saskatoon.—Jackson Machines, Ltd., are increasing their building capacity by three new buildings. This year they are building 250 sheaf-loaders and will increase this number for next year, when they will also be building a low-down type of separator.

PEAT IN NORTHERN ONTARIO.

The Commission that was appointed last year to investigate the possibilities of peat manufacturing in Northern Ontario have, according to one of the commissioners, Mr. A. A. Cole, found conditions to be such as to warrant optimism as regards this resource of the province. About 3,000 tons are now ready for shipment from the Alfred peat bogs in Prescott county, two machines having been in operation for some time. The capacity of the machines now in operation at Alfred is about 100 tons daily, while the market price for the finished product is $4 per ton. It is planned during the next twelve months to enlarge the scope of operations, and considerable attention will be given to the bogs in the vicinity of Cochrane. The power and fuel supply for the mines, especially in the Gowganda district, is becoming each year more pressing, and the promise that peat may be used for the purpose of generating steam to operate the mines is welcomed by the mine operators.

THE ALSATIAN POTASH INDUSTRY.

Mr. Frank K. Cameron, consulting chemist of the United States Bureau of Mines, has recently completed a report on the Alsatian potash industry, which contains information concerning these deposits in Alsace that should prove of decided interest to Canadian chemists.

The Strassfurt deposits in Germany and the Alsatian deposits in the neighborhood of Mulhouse in Upper Alsace are the two best-known deposits of potash salts, and at the oubreak of the Great War were practically the only commercial sources of supply for the entire world. Mr. Cameron points out that in both these deposits their origin was sea-water, the potassium salts being deposited by desiccation, but modifying factors in both cases have caused well-defined and important differences between them.

The Strassfurt deposits occur as potassium chloride or potassium sulphate or both salts, intimately mixed with salts of sodium, magnesium, calcium (lime), and contaminated with substances insoluble in water, such as ferric oxide, clay, etc. The main "potash region" is a stratum varying from 30 to 150 feet in thickness, and at a depth requiring shafts of 5,000 feet.

The Alsatian deposits are quite different, both physically and chemically. The lower bed lies at an average depth of about 1,800 feet practically (though not strictly so, because of faulting), a continuous stratum of a mixture of potassium and sodium chlorides of an area known to be upwards of 77 square miles and of an average thickness approximately 11.5 feet. It is almost horizontal throughout with a dense, compact roof and floor of dry clay, so that mining operations are not difficult.

The average potash content of the Alsatian salt mixture is 18 per cent. K_2O, or possibly 3 or 4 per cent. higher, whereas the average for the Strassfurt deposits is about 12 per cent. K_2O.

The Mines.

There are nine potash mines in Alsace, each with two shafts. Two of these mines belong to a French company, the Sainte Therese, with a main office at Mulhouse, although the ownership is mainly at Nancy. Production had just commenced when the war opened, and during the latter period of the war both mines were flooded, but one shaft has been completely pumped out and mining operations resumed. Little damage was done by the flooding. These French mines, being the last in the field, are better equipped, on the whole, than the others, being provided with magnetic separators to remove iron fragments from the crushed ore. Refineries for these mines are designed but not completed yet.

The other mines (seven) were all owned by German companies before the war, but are now in control of the Sequestrar, an official similar to the United States Custodian of Alien Property. Seven shafts of these German mines are being operated by French army engineers, and the others will gradually be brought into shape for operation.

The German mines in Alsace were controlled by three companies: the Deutsche Kaliwerke, of Bernterode; the Wintershall, of Heringen, on the Werra, and the Hohenzollern, of Freden, on the Leine (Hanover). All were operated under the Kali Syndikat, but the allotments were small, except for the Amelie Mine, belonging to the Deutsche Kaliwerke.

All the mines are operated and lighted by electricity.

Reichwiller, on the main railroad line between Strasburg and Basle, is a nucleus for branch lines and switches from the various potash mines. From Reichwiller potash salts for America would be shipped by rail to Havre, via Strasburg; or, better, by rail to Strasburg and by barge to Antwerp or Rotterdam. Within a few years there will be a good barge canal to Havre, and shipments can now be made via the Rhine-Rhone Canal at Mulhouse for Marseilles. Shipment by way of Rotterdam would seem to be the most advantageous.

Sales from the two French mines are made from the office of the owners of the Societe Kali Sainte Therese, at Mulhouse. Sales from the mines now operated by the French army engineers are made through an office at Mulhouse.

Mining.

The mining operations are extremely simple, and at present about one and a half tons of ore per man per day are sent to the surface, though occasionally an average of two and a half tons has been obtained during a limited period. What the efficiency of the mines were under German control is not known, as the Germans carried off or destroyed all records when they left. The mines never, even under German control, operated at capacity. There is not sufficient labor at present to operate anywhere near capacity.

Cost of Operation.

Mr. Cameron offers as an intelligent "guess" the following figures of the cost per ton, and believes that within a year the operators will have reduced the cost considerably. They are too inexperienced to give accurate figures, though were quite willing.

(1) For potassium chloride, averaging 18 per cent. K_2O or better, putting it down at Havre, Antwerp or Rotterdam, and ready for shipping to America:

	Cost per ton.
Mining	$4.00
Milling	.85
Bagging	1.50
Renewals and repairs	1.00
Office and supervision	.75
Interest	1.00
Freight	2.00
Total	$11.10

Cost per unit of K_2O=.617.

(2) For potassium chloride, averaging 45 per cent. K_2O or better:

	Cost per ton.
Mining	$10.00
Milling	4.12
Bagging	1.50
Renewals and repairs	4.50
Office and supervision	1.88
Interest	3.75
Freight	3.00
Total	$28.75

Cost per unit K_2O=.639

The Future of the Mines.

If all the existing shafts in Alsace were put into maximum producing condition the whole field should produce about 15,000 tons daily of crude salt or one million tons of actual potash annually, about the pre-war demand for all the world, including Germany. Hence the suggestion sometimes heard that an international agreement be effected permitting the Strassfurt mines to supply Germany, and possibly England and Scandinavia, while the rest of the world's market be assured to Alsace. The cost of production at the point of production will always be lower in Alsace than anywhere else, except where it may be obtained strictly as a by-product in a procedure where the cost can be absorbed by another product. It does not necessarily follow that other sources of potash cannot be profitably utilized, because of special conditions of manufacture and transport, and Mr. Cameron hopes that his report will be of value for prospective undertakings in America.

REPORTS AND CATALOGUES RECEIVED.

Laboratory Apparatus and Reagents.—This is a 118-page catalogue gotten out by the J. F. Hartz Co., Ltd., Toronto, replete with illustrations, firmly and also attractively bound. Glassware, including flasks, beakers, hydrometers, funnels, pipettes, etc., is shown and described clearly. The section devoted to autoclaves is specially interesting to plant managers, and would be well worth having on hand.

Railway Equipment for Eastern Roads.—The Department of Commerce, Washington, has prepared a book giving detailed information regarding the market for railway equipment. Price, 35 cents.

Table of Chemical Terminology.—Finding that superintendents and buyers are often confused by the various terms used for certain chemicals, Yocum Faust, Ltd., analytical and manufacturing chemists, London, Ont., have prepared a table giving the chemical terms and common names of the principal materials used in the tanning and textile industries. The booklet should prove useful and may be obtained from the company.

Loose-Leaf Catalogue, No. 1.—The Aluminium Plant & Vessel Co., Ltd., Point Pleasant, Wandsworth, London, S.W. 18, England. The list of aluminium vessels supplied to various industries, as shown in this splendid catalogue, as well as the types of vessels illustrated, conveys an idea of the variety of uses to which aluminium is adaptable. Aluminium apparatus for the chemical industries is well displayed.

TORONTO UNIVERSITY WAR MEMORIAL.

Interest in the War Memorial of the University of Toronto has been very keen recently among graduates of the university. The plan is to raise $500,000 for the erection of the memorial, and the campaign is being directed by Mr. R. A. Cassidy, '01, who has been successful in doing similar work for universities both in Canada and the United States. Mr. Cassidy assisted McGill University in securing an endowment fund of a million and a half dollars; also Dalhousie University in obtaining $400,000, and Mount Alliston, N.B., in raising $250,000.

EFFECT OF BORAX IN POTASH.

The United States Department of Agriculture finds that in some of the Searles Lake potash an amount of borax, from 10 to 23 per cent., is injurious to crops.

Chemical Industry and Labor*

By F. W. WILLARD

THERE appears to be small reason for discussing the threadbare subject in its generic significance, and smaller excuse for wearing it down further to a specific group. There is, however, pressing need to bring to those endowed with God-given sense a glimpse of certain fundamental realities, to remind them of those things they already know, to turn men's minds toward constructive thinking, and, not the least important, to head a new industry into the path which leads to permanence and stability.

If one were to build conclusions from the printed pages of the commercial chemical press he would be forced to believe that the only important subject for the financiers and managers of these nice, new chemical industries of ours is the construction of a tariff bomb-proof. It is difficult to believe, however, that this is true. Some of these men at least know that unless they can build their new industries upon a firm foundation of mutual confidence between themselves and those persons in their employ, no tariff walls nor embargoes, patent monopolies nor subsidies, will save chemical industry in these United States of America.

One hundred and fifty years ago a wise Englishman wrote down in a book some of the fundamental laws governing the social and industrial relations of men. Though he antedated the age of steam, electrical energy, and the explosion engine, he saw and recorded clearly the principles of division of labor, efficiency of production, folly of artificial restrictives, necessity for co-operation, and pointed clearly the direction in which society was then headed. He was no wild-eyed idealist nor idle dreamer. He spoke only of knowledge, and marshalled all his facts into a deadly array of conclusions.

But to-day there arises a generation which knows not Adam Smith, and is flying headlong into experiments which take no account of the experience of mankind.

Instead of pitching in, every mother's son of us, and working to produce the food and the raiment, and the houses which we need, many of us are waving our arms and talking about using some of our ordnance, trinitrotoluol, and small arms to compel those others of us who are alleged to possess all things needful to our happiness, to disgorge food, clothes and houses which are not.

The first thing to do is to go to work, and the next thing to do is to get together and find out how we can all best promote our common interests.

In an entirely natural fashion we have permitted our so-called democratic government to become a shadow of authority and without bestirring our lazy minds to seek realities in social organizations, have encouraged the ever-ready forces of autocracy to honeycomb our society with a multitude of extra-legal despotisms which are all but strangling us. Most of these little autocracies are well organized, efficiently managed, and have very well-defined objectives, which are to squeeze everything out of the many for the benefit of their few. They may be industrial organizations of capital; they may be trade unions; they may be religious hierarchies; but they are all trying to strangle us.

It now happens that, for very obvious reasons, organizations of capital in industry for profit are the targets of popular abuse. They don't deserve it as such; they are our own children grown to be our masters. They are generally controlled by persons of intellectual power and perspicacity, so that they see the dangers ahead and are holding out offers of co-operation. So far as these offers are in good faith they ought to be accepted. Only by the co-operation of the employer and the employed can our civilization be saved.

It is wrong to sit on the side-lines and sneer at the efforts certain very large industries have made to give the employees a real voice in the management of those affairs of the business which directly touch the lives of those employees.

Prosperity of industry is irrevocably linked to the prosperity of those people who contribute to it mental and physical effort. Those who contribute money and those who contribute effort are not natural enemies. They must get together or both will suffer irretrievably. Who will start? Who should start? So far the initiative has been on the part of capital representatives, and the workers, in some instances, have accepted; in others, have hesitated because they were suspicious of the motives of their employers. Covertly, if not openly, doubt and suspicion have been cultivated in the employees' minds by some representatives of organized labor. Likewise, certain employers have not made their offers in entire good faith. But some have made honest efforts on both sides and are making progress.

There are three fundamental principles for the co-operation of labor and capital interests. They are so simple and obvious that one fears to insult the intelligence of the reader by enumerating them, but they are so generally unheeded that it seems necessary to spell them out.

First: Mutual Confidence.

There must exist a basis of mutual confidence between employer and employee, or one must be created before any co-operative plan can be started. To that end, all cards must be placed on the table, faces up. Anyone refusing to follow this principle, no matter who he be, must be eliminated before an organization is started.

Second: Mutual Responsibility.

Both parties to the agreement must assume certain joint responsibilities in the conduct of the business, and in the faithful fulfilment thereof will reside the solidarity of the organization. Those responsibilities are:

Protection of life, health and property.

Prevention of waste of time and materials.

Provision for obsolescence and senility of property and persons.

Third: Mutual Rewards.

Both parties must participate in the rewards of the business after all the above responsibilities have been discharged, and their respective proportions must be determined by mutual agreement after a thorough analysis and understanding of all the facts.

Wages to employees and interest return on the capital account must be fixed on the basis of the economic conditions of the community, and subject to change with the changes therein.

These principles are not idealisms; they do not operate without lubrication, but they are the oldest and best proven of all that man has learned since he quit the solitary for the gregarious life.

* From The Chemical Bulletin, Chicago, Ill.

BUSINESS CONNECTIONS FOR CANADIAN EXPORTERS.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, the Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the number of the inquiry. The initials, "B.T.C.," indicate British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

724. **Minerals.**—An English firm wants Cobalt metal, Cobalt oxide, nickel, nickel matte, molybdenum concentrates, ferro-molybdenum, ferro-silicon, ferro-vanadium, vanadic oxide and concentrates, silico-manganese, silico-mangano aluminum, ferro-chrome, and chromite concentrates, including lead ores and concentrates, pig-lead, copper, other metalliferous ores, ferro and nonferrous alloys, also graphite. Full particulars at the Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

725. **Iron and steel.**—A firm in the north of England.

726. **Electric motors and dynamos.**—A London electrical company.

731. **Cement.**—A firm in Leith, Scotland, wishes to get supplies of Canadian cement.

738. **Asbestos slates and slabs.**—A firm in the Midlands of England.

739. **Crude asbestos.**—A Belgian correspondent.

741. A Scotch engineer who served as an officer for over four years with the Canadian forces in France proposes to return to France and Belgium as representative of a group of manufacturers. Speaks and writes French perfectly. Has influential friends in France. Any manufacturer wishing to join in such a group should communicate with the Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

743. **Exports to India.**—The London representative of an Indian trading company will shortly visit Canada with a view to investigating the possibilities of purchasing Canadian manufactured goods for shipment to India, and would be glad to hear from Canadian manufacturers of the following articles: Hardware, steel and metals, chemicals, boots and shoes, bolts, nuts, lamp glass, sulphur and safety matches, leather and imitation leather, buttons, soap, paints and enamels, Portland cement.

746. **Flint bottles and pots.**—A London importer wants small white flint bottles, unstoppered and stoppered; also machine-made white flint pots for face creams, etc.

747. **Oils and fats.**—A correspondent at Antwerp, Belgium, wants stearine, oleine, lubricating oils and greases, cylinder oil, engine oils, spindle loom soluble oils, cutting compound, dynamo oils, wool oils, etc.

749. **White sugar.**—Inquiry is made by a London firm of cocoa and chocolate manufacturers for the names of Canadian sugar refiners able to ship immediately pure white sugar.

756. **Condensed milk.**—A London firm.

757. **Glass milk bottles.**—A London company.

763. **Raw products and chemicals.**—A firm in Stockholm, Sweden, wants all kinds of raw products and chemicals for industrial purposes and especially with firms who have not yet established connections with Scandinavian countries.

863. **Sodium Peroxide and Metallic Sodium.**—A London company.

875. **Arsenic, Zinc Oxide.**—A Liverpool firm.

874. **Acetic Acid and Formaldehyde.**—A Liverpool firm.

936. **Mineral Oils.**—A Paris firm.

976. **Asbestos Millboard.**—A Glasgow firm.

987. **Drugs.**—A foreign importer desires agency for Canadian drugs.

1000. **Gasoline, Soap.**—French importer.

1001. **Celluloid.**—French importer.

1062. **Ammonia Sulphate.**—A Glasgow firm.

1063. **Acetate of Lime.**—A Glasgow firm.

1117. **Helium Gas.**—A London firm wants names of Canadian manufacturers.

1127. **Sulphate of Ammonia.**—A Liverpool firm.

1160. **Bottles and Glassware.**—A London firm wants names of Canadian makers of druggists' and chemists' glassware, pressed and blown glass.

THE INDUSTRIAL PROBLEM.

At "Our Country-First Conference," a national meeting held under the auspices of the Illinois Manufacturers' Association, Chicago, September 9th last, Mr. Charles Piez, president of the Canadian Link-Belt Co., gave an address on the present industrial situation that received a splendid reception.

Touching on the high cost of living Mr. Piez said: "If the high cost of living is due to profiteering by merchants, manufacturers, employees, farmers or workers, then the government ought to be able to redress it. But if, as is more likely, investigation proves that the high cost of living is due to economic causes beyond the control of this nation, to world-wide reduction of output to a point far below present world-demands, then it will be unwise, to say the least, to meet the situation by a general wage increase, unless that increase is justified by a corresponding increase in effort and output. For, if our premise is correct, then the only way out of the difficulty is to produce more and consume less. Greater production, greater thrift and frugality are the most effective factors in reducing prices, but increased production cannot be achieved unless wages be based on output instead of on hours worked. I recognize, of course, that the objection of certain unions to piece work is well justified because of past abuses of this method of payment, but there can be no question of the soundness and fairness of paying a man for the amount of work turned out, providing the unit or piece rate of compensation is fairly and equitably determined and its permanency guaranteed."

Referring to employees having an interest in the business employing them as stockholders, Mr. Piez declared that such interest must be earned through thrift and sacrifice, in the same way as the present stockholders in most really legitimate businesses earned their interests. "And yet," concludes Mr. Piez, "I am strongly convinced that a real pecuniary interest by the employees in an industry is a good thing, provided that interest is paid for. I am in favor of opening up the opportunity for acquiring a stock interest in an industry to every workman whose length and character of service justifies it, and who has the nerve to assume the responsibility to pay for that interest in cash; and when the stock acquired by workmen and employees reached a proper volume I would gladly welcome a representative of their choosing as a member of the board of directors."

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Alkali Carbonate and Hydraulic Cements from Alkaliferous Silicate Minerals.

E. W. Jungner, 191228, July 1, 1919. An intimate mixture of an alkali silicate, a calcareous material and finely divided C is heated in the presence of CO_2 until the alkali is fumed off. The alkali is recovered from the fume and the clinker used for making cement. The finely divided C is said to insure complete removal of the alkali metal content thus leaving a residue for cement-making free from alkali metals.

Production of Valuable Organic Substances from Waste Liquor from the Sulphite Cellulose Process.

R. W. Strehlenert, 191432, July 8, 1919. Acid gases are introduced into an autoclave containing the waste liquor in quantity sufficient to create a pressure which is considerably higher than the steam pressure corresponding to the temperature in the autoclave, the temperature and pressure being sufficient to cause the self-oxidation of the SO_2. The gases used are preferably those from the sulphite digester at the time of blowing-off for lowering the pressure. The preferred temperature is about 190° C. and pressure about 20 atms.

Manufacture of Calcium Carbid.

F. M. Becket, 191290, July 1, 1919. Aggregates are formed by mixing with previously burned lime a carbonaceous material furnishing the C for the reaction and serving also as a coking binder. The aggregates are then coked while in transit through a heating zone under such conditions as to avoid breaking up the aggregates. Apparatus is also specified.

Explosives and Process of Making Same.

J. R. Donald and J. R. Macauley, 191040, June 24, 1919. Nitrocellulose propellant powders are mixed with an O carrier to produce a disruptive explosive.

Processes of Extracting Silver from Ore.

Martinus H. Caron, 190859, June 10, 1919. Ore containing MnO_2 is subjected to a reducing roast, then cooled to prevent reoxidation.

Electric Furnaces of the Electrode Type.

H. J. Kitchen, 190700, June 3, 1919. The waterjackets surrounding the electrodes of an electric furnace are disposed in intimate contact with the floor of the furnace and carried by arms adapted to slide on a vertical support and to rotate about the same.

Expressing Liquid from Peat.

J. W. Hinchley, 190766, June 3, 1919. Peat at ordinary temperature is subjected to evenly distributed pressure, then a current of hot gaseous fluid is admitted and the peat is thereafter subjected to a higher degree of pressure than that existing during the admission of the fluid.

Sulphur Burning.

G. F. Hurt, 190870, June 10, 1919. A body of molten S is maintained in the burner, a spray of the burning material is produced by a blast of O or air applied within the body of S and a supplemental supply of O is supplied to the sprayed S to support combustion. Apparatus for carrying out the method is also specified.

Separating Suspended Pulp.

Wm. Hoskins, 190881, June 10, 1919. Pulp is separated from sulphite waste liquors by bringing the liquor into contact with immersed limestone which is attacked by the liquor to liberate CO_2. The CO_2 rises through the liquor and carries the pulp to the surface, there forming a scum which may be removed.

Flotation Process.

J. A. Pearce, 191104, June 24, 1919. The process includes aerating the pulp, overflowing the froth, maintaining the tailings in suspension by an upward circulation of the pulp in the flotation compartment and overflowing the tailings wholly from the compartment at a substantial distance above the inlet and in proximity to the level of the overflow of the froth, but separate therefrom.

Treating Waste Liquor from Sulphite Cellulose Factories.

R. W. Strehlenert, 190864, June 10, 1919. The liquor is subjected to concentration by evaporation, then heated under pressure to decompose the liquo-sulphites and liquo-sulphates. The excess heat of decomposition is used to effect the evaporation which may be conducted under vacuum.

Copper Extraction.

A. A. Lockwood, 191091, June 24, 1919. An acid ore pulp is formed and continuously passed between the terminals of an electrolytic cell through which a current is passed to deposit the Cu, the pulp is continuously agitated with air.

Production of Black Upon Textile Fibres.

E. A. Fourneaux, 191071, June 24, 1919. Vegetable fibres are given an ungreenable black color by impregnating them with a solution comprising aniline, strong mineral acid, formic acid, thickening, boracic acid, chlorates of the alk metals, paraphenylene diamine and a Cu salt, drying the impregnated fibre and developing by steaming in an aniline ager. Under the working conditions specified the oxidation takes place rapidly, smoothly and completely, and the black produced is immediately practically free of unstable intermediary products.

Apparatus for Regulating the Acidity of Sulphite Liquor.

J. B. Crandon, 190471, May 20, 1919. This apparatus is for automatically regulating the acidity of sulphite liquors in their manufacture, and is based on the fact that the more available acid in the liquor the greater will be its conductivity and the less its resistance to an electric current.

Process of Obtaining Soluble Potassium Compounds in the Manufacture of Cement.

F. W. Huber, 191327, July 8, 1919. A mixture of flue dust, calcareous material and carbonaceous material is heated to at least red heat, but below that at which large quantities of the K contnt are volatilized. The heated mass is then leached.

Condensing Gases from Electric Furnaces.

I. Hechenbleikner, 191309, July 1, 1919. The solid portion of gases is proportioned electrically and the residual gases passed through an absorption system operating on the counter-current principle. Gases containing P_2O_5 and SiF_4 are thus treated to produce H_3PO_4 and H_2SiF_6. The P_2O_5 is electrically proportioned and brought into contact with water, and the SiF_4 coming in contact with water in the absorption system forms H_2SiF_6.

Paints—A. J. Rossi, et al, 191179.
Electric Furnaces—F. G. Liljenroth, 191004.
Furnaces and Lining Therefor—W. C. Ely, 191063.
Air Feeding Device for Forges—B. H. Tripp, H. V. Ramsay, 190892.
Evaporating Apparatus—K. L. E. Thunholm, 191125.
Cyanogen and Ammonia—P. A. Starke, 190748, June 3, 1919.
Filter Leaf or Disk—O. J. Salisbury, 191113.
Synthetic Production of Cyanides—P. A. Starke, 190747.
Synthetic Ammonia—P. A. Starke, 190746.
Concentrating Sulphuric Acid—I. Hechenbleikner, 191314, July 1, 1919.
Denitration of Sulphuric Acid—I. Hechenbleikner, 191311, July 1, 1919.
Mono and Di Ammonium Phosphate—I. Hechenbleikner, 191312, July 1, 1919.
Cooling and Reducing Nitrate of Lime—I. Hechenbleikner, 191308, July 1, 1919.
Cellulose Acetate—H. Dreyfus, 191302, July 29, 1919.
Cellulose Acetate—Henry Dreyfus, 191300, July 29, 1919.
Sulfonating Benzene and Similar Hydrocarbons—C. R. Downs, 191899, July 29, 1919.
Alcohols—B. S. Lacy, 191542.
Acid Fumes Conveyers—A. B. Porter, 191254.
Extracting Potassium from Its Insoluble Compounds—F. D. S. Robertson, 191260, July 1, 1919.
Hydrolysis of Flue Dust—F. W. Huber, 191328, July 8, 1919.
Process for Effecting Gas Reactions—B. S. Lacy, 191543, July 15, 1919.
Apparatus for Treating Flue Gases Produced in Cement Kilns—F. W. Huber, G. A. Fisher, 191326.
Liquid Fuel—C. H. Warth, 191449, July 8, 1919.
Apparatus for Treating Peat—Chas. Bouillon, 191345, July 8, 1919.
Manufacture of Carbon Blocks—T. W. S. Hutchins, 190414.
Conversion of Chromate and Bichromate of Soda and Potash to Chromic Oxide and Sulphate—F. M. Mooney, 190290.

GOLD IN ABITIBI.

Gold deposits have been discovered in the Abitibi region on the shores of Lake Kienawaieck, on a farm a Polish settler was cultivating. He has just doled out his claim to a British company capitalized in England, and which paid for the property the sum of $850,000.

Analysts of the Provincial Department of Mines and those of the firm declared the ore is very rich.

The firm which will operate this property has been incorporated under the name of the Harricana Gold Mines, Ltd.—The Northern Miner.

CRUDE OIL AT THE PAS.

A sample of crude oil brought from twenty miles southwest of The Pas, Manitoba, has induced a number of prospectors to investigate that locality. It was stated that oil shale was found several weeks ago, but that comparatively little attention was given to this until a bottle of black crude oil was taken to The Pas. The finder stated that he has scooped the oil off the surface of water found bubbling from a spring. The district in which the shale was encountered is quite close to the railway.

RECENT INCORPORATIONS.

NOTE.—The following companies have recently been incorporated. For business purposes communicate to representative of company named.

Toronto.—Morse Oil Co., Ltd. Capital, $1,500,000. Joseph M. Bullen, barrister, Toronto. General production of oil, natural gas, etc.

Brantford, Ont.—Scarfe & Co., Ltd. Capital, $500,000. Reginald Scarfe, manufacturer. To acquire assets and property of Scarfe & Co., and to manufacture paints, oils and varnishes.

Toronto.—Repetti, Ltd. Capital, $100,000. John Forbes, accountant, Toronto. To manufacture and deal in sugar, glucose, confectionery, etc.

Montreal.—Wolf Sayer & Heller of Canada, Ltd. Capital, $250,000. Henry Weinfield, barrister, Montreal. Dealers in chemicals, also to carry on the business of a live-stock market, abattoir, etc.

Ottawa.—J. E. Dennie, Ltd. Capital, $24,000. William H. Dwyer, merchant, Ottawa. Manufacturers and dealers in sulphite pulp, ground wood pulp, sulphate pulp, paper, etc.

Montreal.—Wolf, Sayer & Heller of Canada, Ltd. Capital, $10,000. Manufacture and deal in equipment for railways. Arthur R. Holden, barrister, Montreal.

Montreal.—Leger, Lavoie, Ltd. Capital, $100,000. Edouard E. Leger, contractor, Montreal. Motors, engines, machines, tools, etc., manufacturers and dealers.

Montreal.—Anglo-American Agencies, Ltd. Capital, $200,000. Stephen H. Wiggett, sales manager, Montreal. Manufacturers and dealers in chemicals, drugs, solvents and explosives.

Montreal.—Anglo-Canadian Pharmacal Co., Ltd. Capital, $50,000. Emile A. Brodeur, engineer, Montreal. Chemists, dyers, drysalters, and to manufacture and deal in chemical and pharmaceutical preparations.

Owen Sound, Ont.—Bishop & Pringle, Ltd. Capital, $100,000. Manufacturers and dealers in vinegar, spices, beverages, syrups, etc. Harry C. Pringle, manufacturer, Owen Sound.

Montreal.—Paul Lemaitre, Ltd. Capital, $90,000. Hon. Albert Sevigny, barrister, Montreal. Machinists, founders and metallurgists.

Guelph, Ont.—The Live Wire Co., Ltd. Capital, $100,000. Charles L. Dunbar, barrister, Guelph, Ont. Manufacture and deal in insulated wires and cables, iron, steel; and general mining business.

Montreal.—British Minerals Corporation, Ltd. Capital, $1,500,000. Louis P. Crepeau, barrister, Montreal. Exploring and general mining operations.

Montreal.—Allied Tobacco Planters & Packing Corporation of Canada, Ltd. Capital, $500,000. Benjamin Robinson, barrister, Montreal. To grow and cure tobacco and general tobacco manufacturing business.

Brockville, Ont.—Canadian Sander Manufacturing Company, Ltd. Capital, $20,000. Ray L. Carter, manufacturer, Syracuse, N.Y. Manufacture and deal in machinery, engines, dynamos, etc.

Toronto.—Consolidated Iron & Steel Corporation, Ltd. Capital, $8,000,000. John E. Corcoran, barrister, Toronto. Manufacture and deal in iron, steel and all by-products.

Montreal.—Auto Indicator Sales Co. of Eastern Canada, Ltd. Capital, $25,000. Alexandre Mongeon, merchant, Montreal. Manufacture and deal in motors, engines and machines, etc.

Montreal.—The John T. McBride Co., Ltd. Capital, $200,000. Edward P. Roberts, merchant, Montreal. To purchase present business of John T. McBride, Montreal, to manufacture and deal in foodstuffs and confectioners' supplies.

Toronto.—Mustikon, Ltd. Capital, $250,000. William A. J. Case, barrister, Toronto. To manufacture and deal in rubber goods, rubber cement, automobiles and accessories.

Montreal.—British Refractories, Ltd. Capital, $3,000,000. Thomas Robinson, secretary. Manufacture and deal in terra cotta, cement, tile pipes, paints, fertilizers and artificial stone.

Toronto.—The Sovereign Production Corporation, Ltd. Capital, $1,000,000. James Warburton, solicitor, Toronto. Production and refining of all minerals, oils, etc.

Montreal.—British Foundation Ovens, Ltd. Capital, $15,000,000. Thomas Robinson, secretary. Steel makers, briquette and coke makers, smelters, iron and steel manufacturers.

ELEVATOR EXPLOSION UNAVOIDABLE.

Complete exoneration for all officials and employees of the government grain elevator at Port Colborne, Ont., which was almost entirely wrecked by a dust explosion on August 9th last, was contained in the coroner's jury verdict, held on the remains of two of the victims of the disaster.

Dr. H. Brown, of the United States Department of Agriculture, chemist, one of the experts who investigated the explosion, gave evidence at the inquest. It appeared to him, states the Welland Tribune, that the explosion occurred as a result of a dust cloud created in a lofter and the well of the same lofter; and the belt burning and dropping, which ignited the dust, was immediately responsible for the explosion, the atmospheric conditions having been right for such an event.

"Should it or could it have been avoided?" asked Crown-Attorney Cowper, "and could you put your finger on the man who had been negligent in his duty?"

"No; there was no negligence as far as I could see on the part of anyone in operating the plant, and it is evident that the employees carried out their full duties." He stated that an explosion is liable to occur whenever a cloud of dust is in the air and when a spark or flame exists. He recalled that about three years ago an elevator in the Western States had a similar occurrence, caused by friction setting fire to a belt, the lofters falling and causing dust.

Dr. Brown suggested a remedy to prevent explosions by having a circuit breaker which, when the motor was overloaded, the circuit would be thrown out and the motor and pulley would stop, stopping at once all friction. He was questioned as to the advantages that would be gained by having adequate fire appliances, and he claimed they were normally of no value. He thought that the window space was quite sufficient under normal conditions.

"As a practical man, would you build the elevator again just as it was before?"

His reply was that he would have sprinkler heads in the heads of the lofters, and would also use circuit breakers. Asked by Mr. Parmenter, of the Department, as to the working of a sprinkler scheme in the winter, Dr. Brown said that a heating system would have to be maintained.

The jury recommended that both a circuit breaker and a sprinkling system be installed.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

The movement in all grades of heavy and other chemicals has been quite healthy during the past month, and manufacturers and wholesalers all report "better business" for September than for August With the exception of acetic acid there has been no weakening of prices. Chloride of lime, caustic soda, as well as soda ash, are closely sold up. The surplus supplies of acids which the signing of the armistice last November left on the market in Canada have all been disposed of to United States firms, with the exception of the weak acids, for which, however, there is a good market in Canada at the present time. This has gone a long way toward stabilizing the trade in acids, and sulphuric, for instance, remains firm, the price never varying a fraction of a cent from week to week.

In the United States some large contracts have been signed for bleaching powder. Of the foreign countries Buenos Ayres has ordered heavily from the United States. England is offering considerable competition in the United States on caustic soda, the price on contract at New York being $2.80 per cwt. for 60 per cent., f.o.b. works. A sharp cut was made in New York recently on tartaric acid crystals, a cut of approximately 7 cents per pound, making the price there 79½ cents. This drop was made certainly to reduce competition in second-hands, and owing to betterment in conditions for securing raw materials the cut could readily be made.

METALS.

Steel.—The largest strike in the history of the steel business of the United States is now in progress at this writing (October 1st). Apparently, judging from reports from the several strike centres, the employers are holding the advantage, though it may be a slight one. Reports are conflicting. Officials of the labor unions declare that they are bound to win out, and threaten to call out railway and other employees to gain their objectives. On the other hand, mill managers report that men are returning to work at several points, and that thousands of the men did not wish to go on strike but simply obeyed as a point of loyalty to the union command. The general public, who are bearing the brunt of the strike, are not inclined to favor the strikers. People are about fed up on strikes, and unless workmen can show good reasons, strikes are not going to be at all popular this winter. The sorry part of it is that this strike, which we believe unjust and unreasonable, injures the cause of legitimate labor, where good reason may exist for demanding increased wages. It is not going to reduce the cost of living one cent, but is putting the solution of high prices, so far as the striking steel workers are concerned, farther away than ever.

The effect of the big strike on Canadian steel mills has been one of some advantage. The demand for steel for construction in Ontario is heavy, and the strike in the United States caused some good orders going to Canadian plants. In all lines, except steel plates, Canadian mills were able to take care of the heavy fall business, but where plates were wanted the United States strike did considerable damage to business here.

In considering the Canadian steel situation, it is interesting to note that the Dominion Steel Corporation's new ship-plate mill is almost ready to commence work on the large Canadian Government contract, and that while their plant at Sydney, N.S., has been closed down for alterations and repairs, the increased volume of business, made even larger by the United States strike, necessitates the Corporation reopening the plant earlier than was expected. The Corporation also recently opened up two more coal mines to take care of their increased coal business.

Copper.—Movements in copper have retained their strength throughout the month, though nothing spectacular has taken place, and prices remain at practically the same level. The Consolidated Mining & Smelting Company, operators of the smelter at Trail, B.C., is establishing selling agencies in Europe, a fact that speaks well for the future business of the smelter, and proves that its extensive new plants for smelting lead, zinc and copper have long passed the experimental stage.

OILS.

General trade conditions in oil are remarkably good just now. While prices have remained practically stationary, the market in motor and lubricating oils has been very active, and from all trading points the reports indicate substantial buyings that keep the oil trade generally in category A. So far no strikes or labor troubles have interfered with the oil business, and the trade is certainly on a sound basis, that speaks well for the future. Pennsylvania, crude, is the only oil showing an advanced price, having gone up a quarter of a dollar per barrel, the price at Toronto and Montreal now being $4.25 per barrel of 42 wine gallons.

Linseed.—A peculiar situation has arisen in the market for linseed oil. While the present quotation remains high ($3.25 per gal. wholesale), yet futures are down, and dealers are quoting for contracts for next February at a much lower figure. Supplies of linseed are scarce, and crushers are paying in some instances a premium of 25 cents per bushel for seed for immediate delivery.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	.75
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.04½—.05½
Acetic acid, refined	Lb.	.18½—.19½
Acetone	Lb.	.18½—.23½
Aspirin, in 100-lb. lots	Lb.	1.20—1.25
Alcohol, pure, bbl., 65% O.P.	Gal.	8.25
Alcohol, methylated, bbl.	Gal.	1.35
Alcohol, wood, 95%, refined, bbl.	Gal.	2.25—2.50
Alum, Ammonia, lump	100 Lbs.	5.75
Aluminium Sulphate, high grade, bags	100 Lbs.	3.25—3.50
Ammonia, Aqua 26	Lb.	.09—.12
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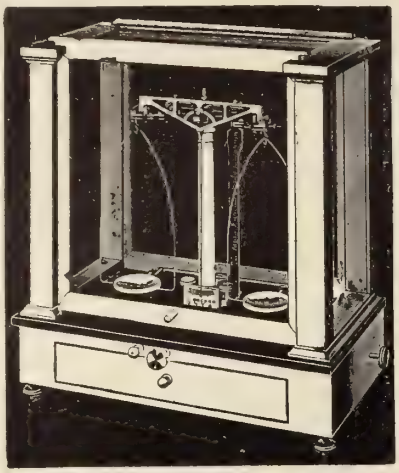

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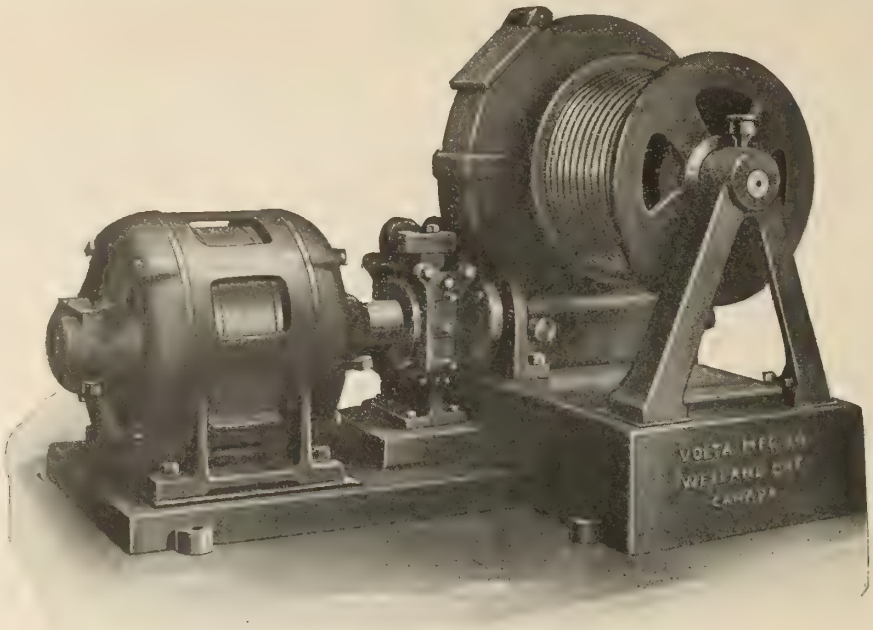

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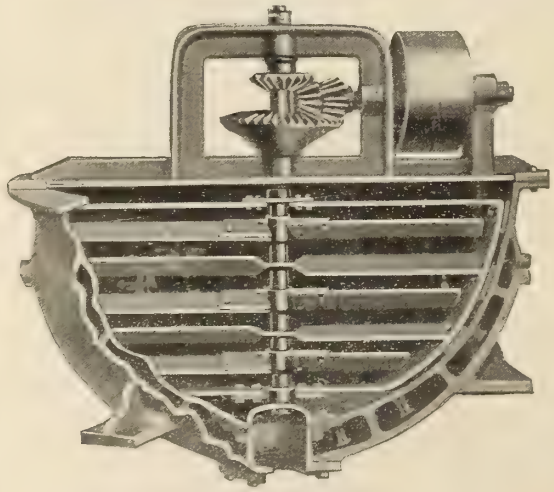

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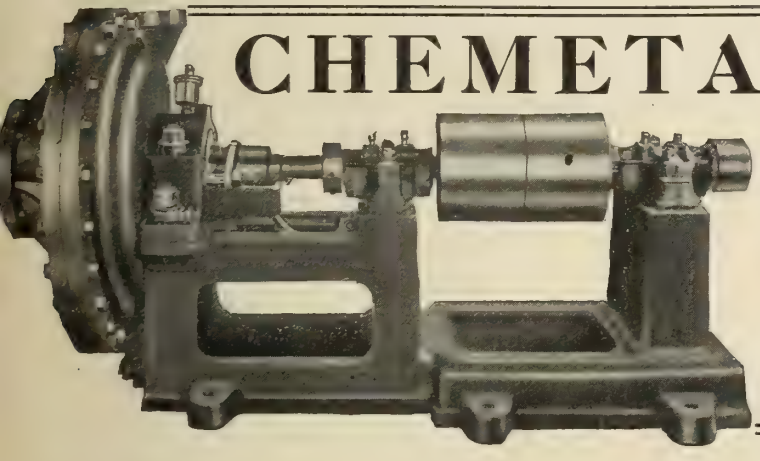

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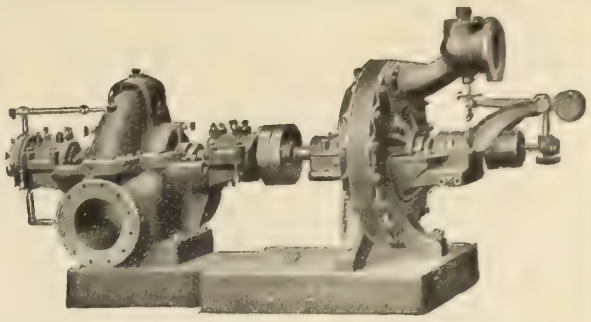

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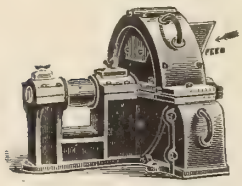

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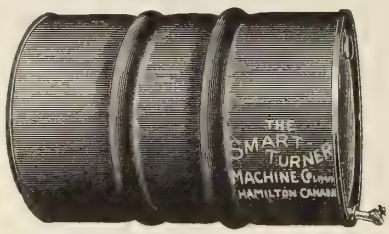

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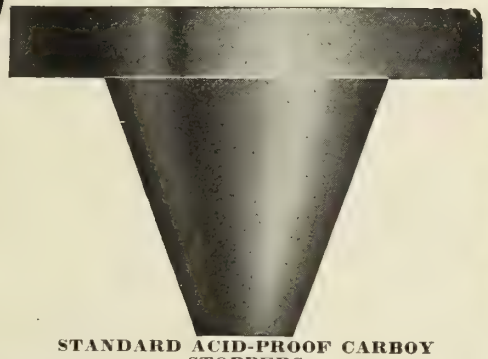

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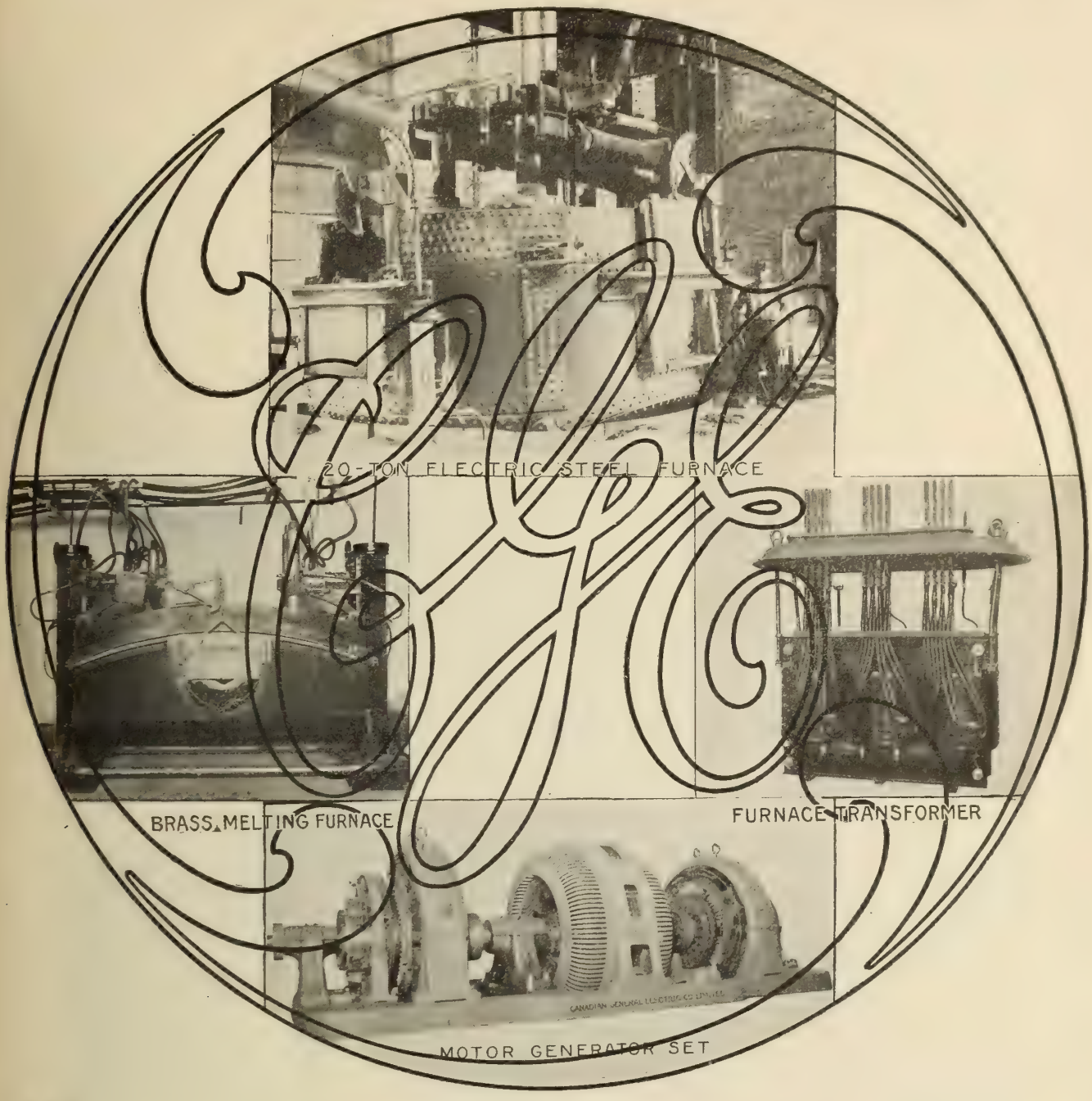

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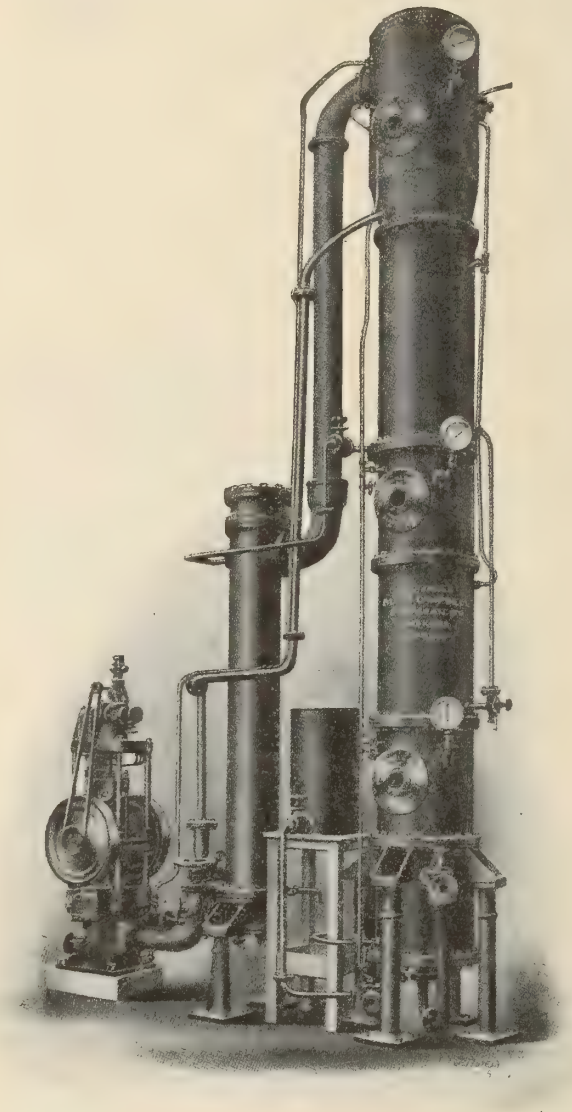

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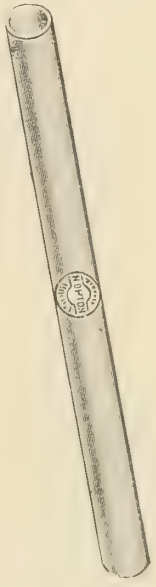

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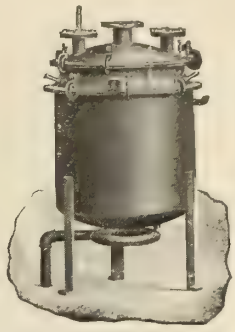

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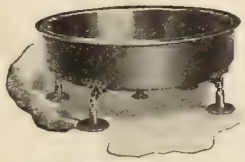

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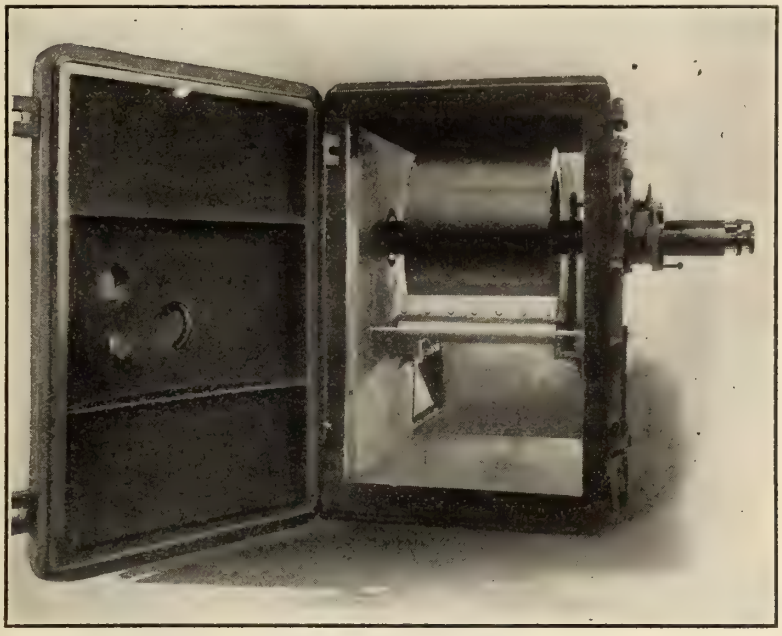

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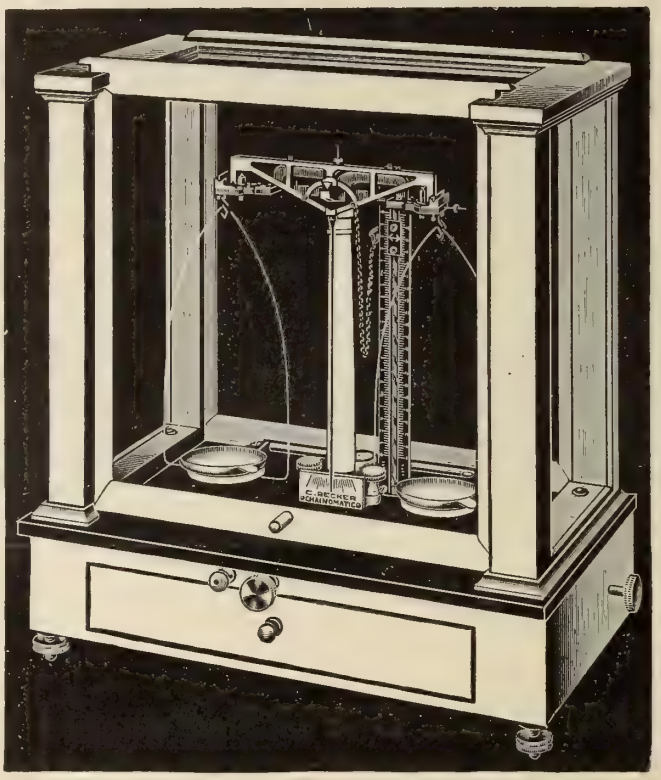

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Vol. 3 TORONTO, NOVEMBER, 1919 No. 11

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EDITORIALS

THE DEVELOPMENT OF SCIENTIFIC CONTROL.

THERE are often many ways of measuring changed attitudes in industry. When the father taught his son all there was to know about the particular trade he would carry on, progress was slow, and methods and ideas did not travel rapidly. In these older days, no practical courses of instruction were given in central schools, and the university had no connection with material things. We have had the general acceptance of the university man by industry, and we have seen the age of professions grow. There still seemed to be something lacking in the machinery for correlating ideas, and an era of trade secrets held full sway. Many of these forces really clogged development, and it was not until universities and individuals advanced the generalizations of pure science that we were able to produce the modern chemist, physicist and highly trained man, who could link up and correlate ideas and properties of matter in such a way as to revolutionize the material progress of the race.

Even yet, industries are very much strung out in their appreciation of the value of scientific control and research. They have not advanced a single step beyond the point they have been forced to attain by stern consideration of what opposition may do. The idea developed that you could buy anything. If someone was foolish enough to work for years in spare time in the cellar perfecting an idea, it was a simple matter to buy his idea if it appeared valuable. It was never dreamed to be good business to pay anyone for such work, or give any opportunity to men who might be successful in modifying a process or inventing a new article.

There are few failures, if any, on record of companies employing research staffs.

In Canada to-day we are told, and unfortunately it seems true, that there are very few companies in all our industries who even yet believe it to be good business to develop their own field by their own research men working as a unit in their general organization. They still belong to the class who think they can buy all the brains necessary on the open market at any time, and are willing to drag along, refusing to advance until their neighbor sets the pace.

There are healthy signs of growth, however, and if we cannot point to research laboratories, we can point to an increasing number of control laboratories where men are daily checking up and standardizing industrial processes, thereby becoming one of the greatest national conservation forces we have. The laboratories are the seed from which we may expect great things. The chemist can teach foremen reasons for empirical operations, and by stressing the technical end of the industry, bring a broader, healthier attitude of mind to the whole mass of workmen in the plant. "Let us all learn together," would be an excellent motto to bear in mind when called upon to enter a plant as the first chemist ever employed.

We are getting scientific control, more laboratories, more chemists employed, and more technical schools.

When this era has progressed a little farther, we may hope for mass action in industrial research, central research institutes, and all the other machinery which it is impossible to find any foundation for now because our industrial men and bankers are not educated up to the point where they see either the necessity or the danger in delay and stagnation. After the patent medicines have all been tried, industrial research will be called to the rescue.

PATENTS.

IN a remarkable way the subject of patents has been brought to the attention of everyone during the last few years. Both in England and America, and in a much smaller way in Canada, the general subject of patents is continually coming up. The complexity of the legal machinery is growing in an effort to keep pace with the unlimited resources of the uhman mind.

In spite of the fact that an inventor is presumed to be protected by law when he has once demonstrated that a new idea has been born and applied, there are so many ways in which he may be legally worried and discouraged that it is really remarkable that we have as many inventions as we do. Generally speaking, it would seem right to increase the incentive to the inventor and diminish the opportunities of those possessed with the necessary money to fight the validity of the patent, simply because it is not in their possession.

The question of patent fees has recently come before the committee of the American Chemical Society on patents and related legislation, and it is generally argued that the present American system, where no annual fee is charged, is as good as can be adopted. In the chemical world of America the German menace looms large, but it seems difficult to allow German patents to be registered in Washington at all and gain much by either a large or small annual fee. In most European countries there are two

forces working to shorten the life of an unworked patent—annual fees and "working" laws of from three to four years.

In England some very interesting views are being passed around regarding the 1919 Patents and Designs Bill. Once again the chemical industries, and in particular those dealing with patents covering the manufacture of dyes, seem to have a large influence in a general bill. The life of the patent has been extended from fourteen to sixteen years, which is still behind the possible nineteen years that may be obtained in the United States. The attitude of patent agents is shown by their regret that such clauses as "substances prepared or produced by chemical processes" should be retained. From the viewpoint of the manufacturer, patents relating to chemical processes are again the hardest to provide for. In the English law, special powers have been given the Comptroller and the Court when dealing with these. This principle may be inadvisable, but it seems impossible to make any better arrangement. The clauses referring to chemical patents clearly protect the process, not the product, and in doing this the inventor is properly safeguarded. With inventors, the feeling remains that the clauses in the proposed English Bill relating to chemical products and substances intended for food and medicines are still quite open to criticism. It is too wide in application and too free with the words "chemical processes." Licenses to work patents "capable of being used" in the production of foods and medicines are to be granted quite freely, and at small expense so that there remains a minimum of incentive to inventors in these fields.

It is exceedingly evident from the history of patent legislation to date, and a review of court cases that there is practically nothing more difficult for the law to handle than matters of claims, disputes, and evidence, submitted in connection with patents where the principles of chemistry play a major part. It would only seem reasonable to suggest that the court should allow representative chemists more freedom in suggesting the nature of portions of acts referring to such matters, and that in the hearing of cases involving a very special knowledge of a narrow chemical field, representatives from our organized chemical societies should be allowed to assist the court in arriving at a reasonable and just decision.

UNFOLDING MINERAL WEALTH.

We have become so accustomed to reading reports of mineral discoveries and are so familiar with the various stages of developments in the history of mining companies, that there is a tendency to forget that the probable resources of the country as a whole have not been even scratched.

Geologists, in the course of a short summer's work in a small district, will report not one but several occurrences which might be developed or which are crtainly worthy of further investigation on the part of capital. There is a natural tendency to do the easiest thing first, and unless an ore of exceptionally high grade, easily obtainable and likely to yield high returns on the investment is obtained, there is an unwarranted delay in attempts made to develop the industry. In a sense, we have been spoiled nationally by Klondyke, Thetford, Sudbury, Cobalt and Porcupine discoveries. The idea of developing mineral wealth in the same plodding fashion that must be applied to any other business has been somewhat lost. We have too much of the "rush" still attached, and all this has come about because we are a few people in a large country. The precious metals have dimmed our eyes to many economic mineral occurrences, and it would, perhaps, be beter if we forgot all about gold, silver and nickel for a little time, and in the interval, survey the field in other directions.

A recent report on the Clinton district, of British Columbia, illustrates very well the state of our knowledge relating to occurrences and the immediate use that can possibly be made of the information available. Dr. L. Reinecke reports valuable occurrences of sodium and magnesium salts, the presence of molybdenite, chromite, gold, copper, silver, manganese, nickel, muscovite and peridot, the precious form of olivine. From preliminary examination, the values of these deposits are impossible to gauge, but the report does express the hope that some firm will have the enterprise to prepare olivine for the market from the only known gem locality of commercial importance in the Dominion. In one small district of a few miles, we thus have several known occurrences of possible worth. There has been gradually built up an enormous amount of information of this kind. Our geologists have, for the number employed, gathered a world of information. In every province, it is known that minerals occur, but often spasmodic efforts have ruined the chances of whole districts. The history of mining in Central Ontario is stated by some to be a classic example of this. We are still looking for the needle in the haystack and the unwarranted success obtained in a few instances tends to discourage the development of average possibilities. If we suddenly discovered platinum footballs in the bottom of some creek we would immediately consider that we had done something towards developing the resources of the country. If high-grade ores of mercury could be steam-shoveled into cars we would probably be in the market with

a world's supply and continue to take some credit for the accomplishment.

It is not our desire here to criticize what has been done, but rather to point out what remains for the future, and to encourage those who are endeavoring to bring about a more logical and full development of these resources through the adoption of known or new metallurgical principles. Capital and men are necessary, but above all more encouragement must be given to metallurgical industries and the general business of utilizing Canadian ores and minerals not in precious metal groups. The sceptical attitude must be avoided and the research attitude developed. Our ore deposits should not be approached from the viewpoint of making a fortune or selling stock, but as opportunities for the investment of capital willing to build up a business on the assurance of reasonable returns, trusting to the application of scientific principles to overcome apparent difficulties.

A PROFITABLE DUTY.

THE Chemical industries and industries directly dependent upon the manufacture and use of chemicals have been reborn and placed on a rock foundation in Canada. Now we must hold the line for Canadian credit. This is what the Victory Loan will do, and there should be no limit to our faith in our own country. Express it in dollars loaned.

THE CANADIAN INSTITUTE OF CHEMISTRY AND SALARIES OF DOMINION GOVERNMENT CHEMISTS.

It is worthy of note that the Institute is already busy in the field it has chosen. The Dominion Government is the largest employer of chemists in Canada, and the Institue has not been found lacking in supporting their just claims for a reconsideration of the original classification as recently handed down by those appointed to reclassify Civil Servants according to duties and to stipulate salary limits. The following letter has been addressed to the Civil Service Commission, and should be taken as a token of the good work the Institute may do in guarding and developing the profession within the Dominion:

Sept. 17th, 1919.

The Civil Service Commission,
Ottawa, Ont.

Dear Sirs,—The Canadian Institute of Chemistry has been founded by the chemists of Canada for the purpose of organizing the profession with a view to increasing its usefulness to the country. Matters dealing with inside professional questions, as well as those dealing with the larger relation of the profession to the public, come within its purview. In both connections, the Institute is directly interested in the proposed scheme for the classification and remuneration of the chemists in the Civil Service.

In addressing you, who are familiar with the work of chemists in peace, as well as in war, it is not necessary to recount in detail the various services which they undertake, but we desire to draw your attention to certain anomalies in the proposed classification of Civil Service. To quote merely a few instances, we find that the following salaries are set down in connection with the positions named:

Assistant	Chemist	$1320—1680.
"	Ceramist	1680—2160.
"	Zoologist	1680—2400.
"	Geologist	1680—2400.
"	Agrostologist	1680—2100.

It cannot be argued that a chemist has had a shorter or less rigid course of training than has any of the other professional men named, and indeed, the proposed schedule shows that men of a lower educational standard and with less experience, are recommended for equal or higher salaries.

The effect of the establishment of the salaries proposed in the classification upon the chemist personnel of the Civil Service is a subject to which we request your careful attention. It is obvious that if chemists are to receive salaries lower than those of geologists, ceramises, zooologists, etc., that more capable and energetic men of the profession will avoid the Civil Service on account of the discrimination against them in favor of their fellows and equals at the universities and colleges.

At a time when there is a widespread demand for Scientific and Industrial Research—to which the chemist has made contributions which are second to none—it has caused surprise and regret that the Civil Service Commission has failed to grant to our profession even that recognition which they have extended to others of like attainments.

You will recognize, we are sure, that chemists have played and will play an important role in the development of the industries of the country, but the salaries set down in the classification appear to indicate that, in your opinion, the services of the chemist are of inferior value to those rendered by other scientific men.

The Ottawa Branch of the Society of Chemical Industry have presented to you a memorial in which they make certain proposals regarding the salaries for chemists with details covering their duties and qualifications. To avoid nay mistake, these figures are quoted below in abbreviated form:

Laboratory Assistant	$ 900 to $1500.
Junior Chemist	1860 " 2100.
Assistant Chemist	2220 " 2700.
Associate Chemist	2760 " 3300.
Chemist	3300 " 4200.
Chief Chemist	3600 " 5100 and up.

The Canadian Institute of Chemistry, which represents the organized professional chemists of Canada, desires to request you to take into your earnest consideration this and other protests against the salaries allotted to chemists in the proposed classification, and the Institute wishes to urge you to adopt the schedule of salaries proposed by the Ottawa Branch of the Society of Chemical Industry, as being more in accord with the compensation received by chemists who are not in the service of the Government.

We have the honor to be, sirs,

Yours very truly,

CANADIAN INSTITUTE OF CHEMISTRY,
Per (Signed) J. Watson Bain, President.
(Signed) Harold J. Roast, Secretary-Treasurer.

Preparation of Manganates and Permanganates of Metals of Alkali and Alkaline Earth Groups

By CHARLES A. H. WRIGHT.

1.—Previous Work on Manganates and Permanganates.

THE high cost of potassium permanganate (1) during the last few years has suggested the desirability of obtaining a better knowledge of the conditions under which various manganates and permanganates are formed, particularly as previous studies of these reactions have led to two different theories. The work here described has to do mainly with the sodium and potassium salts. Preliminary results show, contrary to expectations, that the reactions distinguishing the common alkali salts are quite different, and consequently this work has been extended to include a study of the reactions involved when, under similar working conditions, barium hydroxide and barium dioxide, strontium hydroxide, calcium hydroxide, aluminium hydroxide and the oxides of magnesium, copper and zinc in turn are substituted for the sodium hydroxide used in the preparation of sodium manganate.

Potassium permanganate is manufactured on a large scale by a two -stage process, consisting of the preparation of manganate by roasting a potassium hydroxide-manganese-dioxide mix, followed by conversion of manganate to permanganate by extracting (2) the mix with water. This investigation limits itself almost entirely to the first stage, namely, the manufacture of manganates, since the change to permanganates takes place easily on acidifying or oxidizing electrolytically.

The most recent study on manganates and permanganates has been made by Schlesinger, Mullinix and Popoff (3), who summarize previous investigations and the results of their own work as follows:

"The conversion of manganese dioxide into potassium manganate by heating it in a current of air with potassium hydroxide has been extensively investigated. The most recent, and apparently the most thorough, of these investigations are those of Askenasy and Klonowski (3a) and of Sackur (3b) and his associates. The researches of the two groups of investigators do not lead them to the same conclusion. While the first-named seems to hold to the opinion that the reaction follows the course found in the text-books, represented by the equation,

(1) $4KOH + 2MnO_2 + O_2 = 2K_2MnO_4 + 2H_2O$,

Sackur concludes that potassium manganate is never formed in this way, but that the product obtained in the reaction is a mangani-manganate, which can be represented by the formula $2K_2MnO_2$, $3K_2MnO_4$, $3K_2O$. In this conclusion he is corroborated by the work of Auger (3c), who obtained a compound of similar composition by heating potassium permanganate with excess of potassium hydroxide. If Sackur's conclusion be correct it is clear that the highest yield that could be obtained in the reaction in terms of the amount of manganese dioxide oxidized to the manganate stage could be only 60 per cent., since the remaining 40 per cent. must always remain as manganite. In support of this consequence of his theory of the course of the reaction, Sackur cites his own experiments, which of Askenasy and Klonowski, who obtained similar yields, of Oskenasy and Klonowski, who obtained similar yields, and the statements made personally to Sackur by German manufacturers that a yield of 60 per cent. was the maximum attained in practice. When we first undertook this investigation the manufacturers with whom we were cooperating were not obtaining yields as high as those demanded by Sackur's theory, and we therefore attempted to determine the best conditions for duplicating his results. The outcome of this work has been to show that Sackur's theory is incorrect, for we were able to obtain yields corresponding to a conversion of over 98 per cent. of the manganese dioxide into the manganate."

Results of this investigation have confirmed those obtained by Schlesinger, Mullinix and Popoff in case of the potassium salt, but with sodium hydroxide or dioxide the maximum yield was found to be 60 per cent., which fact lends support to Sackur's theory of the formation of a mangani-manganate as represented by the equations—

(2) $32NaOH + 10MnO_2 + 3O_2 = 2(2Na_2MnO_2, 3Na_2MnO_4, 3Na_2O) + 16H_2O$.

(3) $16Na_2O_2 + 10MnO_2 = 2(2Na_2MnO_2, 3Na_2MnO_4, 3Na_2O) + 5O_2$.

2.—Preliminary Experiments, Apparatus, Methods and Analyses.

Preliminary experiments showed that the fineness of the reacting materials and the temperature had a great effect on the yield of manganate. The pyrolusite used was ground to 200 mesh and the basic material to an impalpable powder. A temperature of 500° C. for one hour produces the maximum yield, and consequently this was the temperature maintained in the furnace during roasting. The apparatus in which the mix was roasted consisted of a small electric furnace, the temperature of which could be maintained constant within a few degrees at any point between 100°C. to 1,000°C. The analysis of the manganate mix consisted of extracting with water and titrating the permanganic acid with standard ferrous sulphate solution.

The percentage yield has been calculated on the basis of manganese dioxide to manganate. The pyrolusite used was first analyzed for manganese dioxide by a determination of the oxidizing power, and from this analysis, weight of manganese dioxide in 1 gram of mix before roasting could be determined. From the percentage of manganate in the calcine it is an easy matter to determine the equivalent weight of manganese dioxide in 1 gram, and hence to calculate the yield. This method would be accurate if there were no difference in weight of the mix before and after roasting. From equations (1), (2) or (3) it is quite evident that there must be a difference in weight, the mix before heating being the heavier of the two, hence the calculated yield is in slight excess of the true yield.

3.—Results of Experiments With $NaOH—MnO_2$ Mixtures.

From a long series of experiments it was shown quite conclusively that the maximum yield of manganate obtainable in the case of sodium was 60 per cent. of that possible, according to the general theory as represented in the text-books. The experimental data obtained by roasting manganese dioxide and sodium hydroxide, through a range of molecular ratios from .5 to 6.0, is given in the following table:—

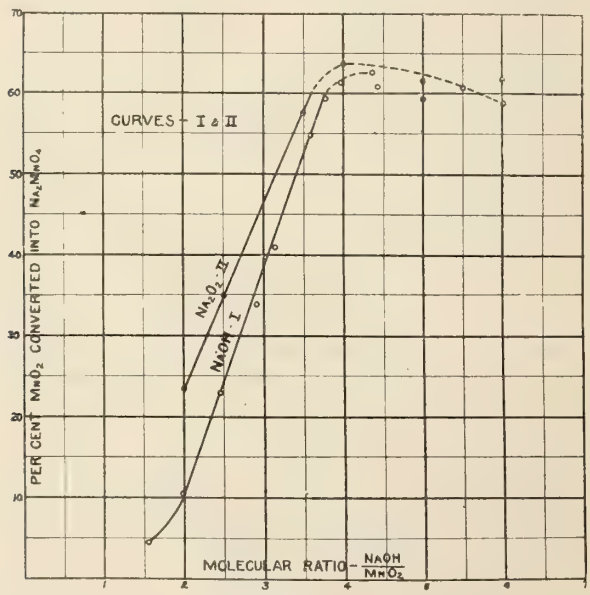
TABLE I.—Showing the Influence of Variable Molecular Ratios of Sodium Hydroxide and Manganese Dioxide on the Yield of Manganate.

		— Brown —						— Green (dark to light) —						
Per cent. MnO_2 in ore..	76.8	63	63	63	63	63	63	63	63	63	63	63	76.8	63
Molecular ratio $\frac{NaOH}{MnO_2}$.	.5	1.19	1.54	1.99	2.47	2.92	3.14	3.58	3.77	3.97	4.37	4.42	5.0	6.0
Per cent. Na_2MnO_4 ...	—	Trace	3.5	8.0	16.0	22.0	25.2	32.0	34.0	34.0	33.0	33.0	31.3	27.0
Yield	—	Trace	4.3	10.5	22.9	33.9	40.9	54.8	59.3	61.3	62.6	60.8	59.2	61.9

In above table, row 1 is self-explanatory, representing the percentage of manganese dioxide in the ore. Row 2 represents the ratio of moles of sodium hydroxide to the moles of manganese dioxide. If equation (1) represented the form of the reaction, the ratio 1.99 should correspond to a yield approximating 100 per cent.; the small yield of 10.5 per cent. indicates that equation (1) does not represent the form of the reaction. Row 3 represents the percentage of manganate in the mix after roasting. The last row represents the calculated yield which, as explained above, is probably in slight excess. By analysis of the mix for manganate and total manganese, an accurate calculation of yield could be made, or by analysis of the total mix for manganate an accurate result could be obtained. The latter suggestion is not practicable under most conditions, and the former makes the work much more extensive. The approximation made, gave results close enough to the accurate for our purpose.

The brown-colored substance resulting from the roasting of a mix in which manganese dioxide is in great excess is due, probably, to the formation of a compound other than manganate or permanganate, since neither the manganate ion MnO_4'' nor the permanganate ion MnO_4' is produced on extraction of the calcine with water. From the molecular ratio of 2.47 to molecular ratio 6.0 the color of the compound formed, believed to be a mangani-manganate (see Eq. 2), is green, varying from a dark to a lighter shade as the ratio is increased. Beyond the ratio 4 to 5, dependent on percentage composition of ore, the mix becomes pasty when roasted, and, therefore, around these ratios it is difficult to work with accuracy.

The formation of mangani-manganates and not manganates in this case is borne out by the appearance of the products. Mangani-manganates are green, while manganates are of a violet, almost black, hue. All the products from ratio 2.47 to 6.0 were green, and none of them were of the manganate color. The maximum yield attained—namely, 60 per cent.—also points to the formation of a compound other than manganate. This maximum yield, according to experimental results, is reached by use of sodium hydroxide and manganese dioxide in the molecular ratio of 3.8. This is in excess of the theoretical



ratio 3.2, according to equation (2), and although the reason for the excess has not been proven, it is probably due to the impurities—mainly silica—in the pyrolusite. Whether or not the excess had theoretical significance might be ascertained by a determination of the yield after roasting pure sodium hydroxide with pure manganese dioxide in the molecular ratio of 3.2.

The lower yields that have resulted from the use of ores relatively low in manganese dioxide suggest that a portion of the sodium hydroxide unites with the impurities, and hence it is to be expected that for the maximum yield of 60 per cent. an excess of sodium hydroxide over the theoretical would be necessary.

Results of experiments with Na_2O_2—MnO_2 mixtures confirmed those obtained by use of NaOH. The data is represented graphically by Curves I. and II. Curve I. represents the course of the reaction between sodium hydroxide, manganese dioxide and oxygen, and Curve II. the reaction with the dioxide substituted for the hydroxide. Since both curves are straight lines, the yield must be directly proportional to the relative amounts of the hydroxide or dioxide used. The maximum yield of 60 per cent. is reached when the molecular ratio reaches the value 3.6-3.8, the excess over the theoretical 3.2 being due, as previously explained, probably to the impurities in the ore. Above the ratio 4 the mixture becomes pasty, and it is difficult to obtain an accurate sample, hence the irregularity in the curves. The hydroxide presented greater difficulties when used in mixtures of high ratios than the dioxide, and hence Curve 1 shows greater irregularity than Curve II. The descending portion of Curve II., after the ratio 4.0 is passed, is probably due to the reduction of permanganate caused by the hydrogen peroxide formed from the excess dioxide.

The green product when exposed to the action of the atmosphere changes to a brown compound, which on examination was found to be permanganate. This change is the effect of the action of the moisture and carbon dioxide present in the air, and may be represented by the following equations:—

(4) $3Na_2MnO_4 + 2H_2O = 2NaMnO_4 + MnO_2 + 4NaOH$

(5) $3Na_2MnO_4 + 2CO_2 = 2NaMnO_4 + MnO_2 + Na_2CO_3$

From the experimental data included in the preceding pages it is concluded that in the case of sodium a complex compound, of the form $2Na_2MnO_3$, $3Na_2MnO_4$, $3Na_2O$, is formed when the hydroxide or dioxide is roasted with manganese-dioxide in the presence of oxygen or air, and that the maximum yield obtainable is therefore 60 per cent.

4.—Results of Experiments With KOH—MnO_2 Mixtures.

The results obtained by use of potassium hydroxide in the reaction for the formation of manganate have been obtained under the same working conditions as those given in the case of the sodium salt. While a yield of 60 per cent.

of the sodium salt was found to be the maximum obtainable, roasting of potassium hydroxide and manganese dioxide in the proper molecular ratio yielded 100 per cent. of manganate. Schlesinger, Mullinix and Popoff worked with the potassium salt and obtained a yield approximating the theoretical of 100 per cent., showing that the reaction progressed according to the following equation:—

$$(6)\ 4KOH + 2MnO_2 + O_2 = 2K_2MnO_4 + 2H_2O.$$

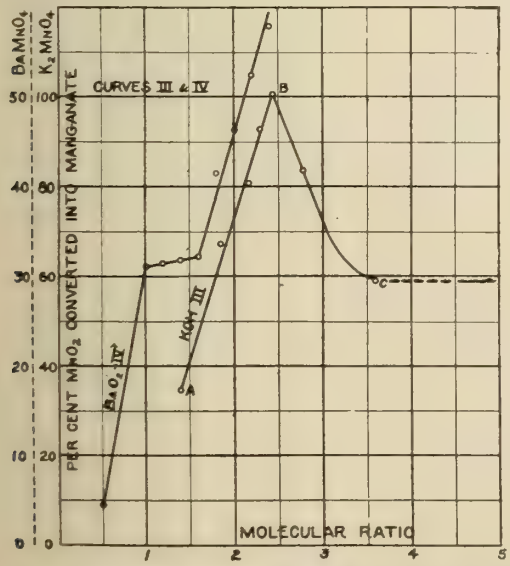
Table II.—Showing the Influence of Variable Molecular Ratios of Potassium Hydroxide and Manganese Dioxide on the Yield of Manganate.

% MnO_2 in ore.	76.8	76.8	76.8	76.8	77.8	77.8	76.8	76.8
Molecular ratio: $\frac{KOH}{MnO_2}$ ...	.67	1.39	1.85	2.16	2.30	2.43	2.77	3.6
% K_2MnO_4	Trace	34.3	58.4	64.5	71.0	75.7	59.2	41.2
% Yield	—	34.5	67.2	80.6	92.4	100.8	83.4	58.8

This series of results agrees very well with those obtained by Schlesinger, Mullinix and Popoff. It will be noticed in above series, Table VII., that, as in the case of sodium, an excess over the theoretical of potassium hydroxide is necessary to obtain the maximum yield. This excess, as was the case with sodium, is probably due to the impurities in the pyrolusite. The potassium hydroxide used was considered 90 per cent. KOH, due to a variation in the material of from 85-90% pure potassium hydroxide.

Schlesinger, Mullinix and Popoff in their recent paper lay great stress on the beneficial effect of moistening the mixture on the yield of manganate. In experiments with sodium and potassium remoistening of the mixes was carried out in several cases, but in none was it found that the yield of manganate was increased thereby. In some cases the yield of manganate seemed to be decreased by moistening the mix and reheating. The yields obtained were the result of roasting in a dry atmosphere without remoistening.

Curve III. (see below) represents graphically the course of the reaction. It will be noticed that the yield of manganate is proportional to the relative amounts of potassium hydroxide in the mix, and that after passing the ratio 2.43—the ratio of maximum yield—the yield decreases regularly as represented by CC. If the reaction follows that represented by equation (7) it should theoretically reach 60 per cent., at a ratio of 3.2, but, as expected, it is slightly in excess of this ratio, due to the effect of impurities present in the ore.



A compound similar to the bright green colored mangani-manganate obtained with caustic was evident in this series only when a great excess, as in ratio 4, of potassium hydroxide was present; with intermediate molecular ratios the color of the compound formed was very dark, almost black, and this compound, on addition of excess potash, changed to the green mangani-manganate. As in the case of sodium, the compound formed with potash, if exposed to atmospheric action for a few hours, changes to the permanganate of potash.

Authorities state that manganates are of a very dark violet hue, while mangani-manganates are green. This statement supports the view that in the case of sodium a mangani-manganate is formed, while in case of potassium the pure manganate is first formed, and then by presence of excess potash the green mangani-manganate results, according to the following equation:—

$$(7)\ 5K_2MnO_4 + 6KOH = 2K_2MnO_3, 3K_2MnO_4, 3K_2O + 3H_2O + O_2.$$

5. A series of tests similar to those of sodium and potassium was carried out with BaO_2—MnO_2 and $Sr(OH)_2$—MnO_2 mixtures. In both cases a complex salt was formed, but while with the former a yield of 60 per cent. manganate was obtained, with the latter the maximum yield was only 20 per cent. The green mangani-manganates of barium and strontium were apparently unaffected by atmospheric action.

$Ca(OH)_2$, $Al(OH)_3$, MgO, CuO and ZnO were roasted in varying molecular proportions with manganese dioxide at temperature between 300°-1000° C., but in these cases an inappreciable amount of manganate—if any at all—was formed.

Summary.

I.—It is found that when manganese dioxide is roasted with potassium hydroxide in a current of air, a yield of 100 per cent. of potassium manganate is obtainable, but with sodium hydroxide, sodium peroxide, or barium dioxide, the maximum yield of manganate is found to be 60 per cent. With strontium hydroxide, manganese dioxide mix roasted in a current of water—carbon dioxide—free air, the maximum yield is found to be 20 per cent. Calcium hydroxide, aluminium hydroxide, magnesium oxide, copper oxide or zinc oxide, roasted with manganese dioxide at temperatures ranging from 500°-1000° C., do not form manganate.

II.—The yield of manganate varies greatly with the proportion of hydroxide in the mix. The molecular ratios corresponding to the maximum yields at the temperature 500° C. are as follows:—

	Yield of Manganate	Molecular Ratio.
Potassium hydroxide	100%	2.43
Sodium hydroxide	60%	3.77
Sodium dioxide	60%	3.74
Barium dioxide	60%	2.5
Strontium hydroxide	20%	1.9
Calcium hydroxide	—	—
Aluminum hydroxide	—	—
Magnesium oxide	—	—
Copper oxide	—	—
Zinc oxide	—	—

The above series is representative of the variation of yield with elements of increasing atomic weight and increasing basicity, and it would probably be found that

with the bases stronger than potassium, namely, rubidium and caesium, a yield of 100 per cent. manganate would result, and by the same process of reasoning, with radium and lithium hydroxides, we would expect a yield of not less than 60 per cent. manganate.

III.—In this work, moistening and reheating did not increase the yield of manganate. This result is contrary to that of Schlesinger, Mullinix and Popoff.

IV.—The conclusions of Schlesinger, Mullinix and Popoff in the case of potassium have been proved correct, and those of Sackur, in this connection, incorrect. Sackur's conclusion that a mangani-manganate is formed in case of sodium is supported by experiments above, which also point to the formation of a complex manganate compound in the case of barium and strontium.

V.—In the case of potassium excess alkali causes the manganate to decompose into a mangani-manganate, similar to, if not identical with, that postulated by Sackur.

VI.—In the case of barium excess alkali causes a decomposition of the permanganate formed when the mix is extracted with water and nitric acid on account of the reducing action of the hydrogen peroxide formed.

VII.—It is found that the manganates of potassium and sodium are changed to the corresponding permanganate by the action of the carbon dioxide and water in the atmosphere, while those of barium and strontium are unaffected by these agencies. The latter manganates cannot be changed, quantitatively, by use of sulphuric acid, carbon dioxide or sulphur dioxide. Nitric acid effects a quantitative change.

Suggestions for the Manufacture of Manganates.

I.—From Schlesinger, Mullinix and Popoff:—

(a) "It is very important to pulverize the ores very finely, and to keep them finely divided in the kilns in order to obtain the highest possible yields. Some ores are more difficult to handle in this respect than others."

(b) "The residual manganese dioxide sometimes deteriorates on repeated use. This may be caused by absorption of impurities from the solution of the dioxide before it has had time to dry out; if thoroughly washed with water or boiled with dilute nitric acid, its effectiveness for the process may be restored."

II.—It is advisable to use ores of a relatively high degree of purity, since impurities, such as silica, unite with sodium hydroxide at the temperature (500° C.) of the process and thus lower the yield.

III.—For the best yields it is advisable to use a current of air free from water and carbon dioxide. Although continual stirring is unnecessary, it is no doubt advisable to keep the materials intimately mixed.

IV.—The time required to complete the oxidation to manganate with mixes of half-inch thickness, stirred at half-hourly intervals, is from one to two hours.

Notes.

(1) Potassium permanganate has been employed in the laboratory for a long time as an oxidizing agent, and it is largely used in volumetric analysis. Hoffman in 1859 showed that this salt, together with other manganates and permanganates, acts as a valuable disinfecting agent, and its application for this purpose has now become so general that these compounds, which at that time were found only in the laboratory, are now made in thousands of tons.

(2) Manganate extracted with water reacts by hydrolysis to form permanganate, according to the following equation:—

$$3K_2MnO_4 + 3H_2O = 2KMnO_4 + MnO_2 + 6KOH.$$

The rate of this reaction is increased by addition of acid, or by boiling, or by passing carbon dioxide, sulphur dioxide, or chlorine through the solution. Secondary reactions result in some cases, due to the presence of manganese dioxide, causing a reduction of the permanganate.

(3) Journal of Industrial and Engineering Chemistry, Vol. II., No. 4 (1919), pages 317-323.

(3a) Z. Elektrochem, 16 (1910), 104, 170.

(3b) Ber. 43 (1910), 381, 448; 44 (1911), 777; Z. Elektrochem, 16 (1910), 649; 18 (1910), 718; Z. anorg. Chem., 73 (1912), 101.

(3c) Compt. rend., 151, 69.

From Department of Chemistry,
University of British Columbia,
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MAGNESITE INDUSTRY OF CANADA.

Though the ultimate prospects for the magnesite industry in Canada are good, at present conditions are quiet, and it is not to be expeted that the high-production record of 1918 will be reported for 1919. In 1918 the total production of magnesite in the Province of Quebec (the chief source for the Dominion) was 28,564 tons, valued at $1,016,764. During the war the magnesite industries of Quebec were pushed to the limit to keep up with the demands of the Department of Militia and Defence. Following the cessation of hostilities there was enough stock on hand to take care of the normal trade for the balance of the year. In the opinion of many Canadians magnesite can compete successfully with either Austrian or Grecian. While the proportion of lime in Quebec magnesite is higher than that of Austrian (and some were prejudiced to Quebec magnesite on that account), yet by strict chemical control in its manufacture all free lime has been eliminated from the Quebec product, and a finished article is produced, the equal of either that of Austria or Greece. As a reminder that the magnesite industry in Canada has a bright future the announcement was made a few weeks ago that a $100,000 plant was to be erected at Calumet, Quebec, by the North American Magnesite Company.

OIL SHALES OF UNITED STATES.

The possibility of using the oil shale deposits of the United States as a source of liquid fuels is under consideration. These are found in several portions of the country, but those of Utah and Colorado are the most extensive. At first glance this material shows no signs of oil, but when it is heated the organic materials in its composition are broken up, and among other things oil and gas are obtained. The yield varies from 6 to 90 gallons of crude oil per ton of shale, which will yield 7 to 12 per cent. gasoline, 28 to 44 per cent. kerosene, and other valuable products. Considerable use is made of shale oil in England and Scotland.

Factors Governing the Structure of Electro-Deposited Metals*

A Review of the General Principles Applicable to Electroplating With Experiments Designed to Point Out the Effects of Changing Various Factors in Plating Conditions, Followed by Practical Recommendations

By WILLIAM BLUM.

Note.—A paper presented at the thirty-sixth general meeting of the American Electro-Chemical Society, Chicago, September 23-26, 1919. A series of twenty photographs illustrating experimental results were presented with original paper.

Introduction.

IN spite of the great number and variety of papers published upon electrodeposition it is significant that few attempts at generalization have been made. In consequence we find even in the results of scientific research a tendency toward the recommendation of empirical formulas and conditions which are not correlated and sometimes contradictory. If rapid progress is to be made by investigations in this field it is essential that such studies should be conducted from the standpoint of general principles, so that the results obtained in any given study may be applicable, in some degree at least, to other kinds and methods of plating. Only by some such course may the electrochemists of this country render adequate service to the electroplaters in their admittedly empirical art.

Of the suggested generalizations in this field the most comprehensive are those contained in Bancroft's so-called "axioms of electroplating," first offered[2] in 1904 and reiterated in 1913.[3] On the latter occasion Prof. Bancroft invited discussion and criticism of these axioms, but so far as known to the author no systematic experiments have been conducted to determine their validity since the original experiments of Bancroft and Snowdon. In an extended study at this Bureau of deposits from the silver voltameter[4] the results obtained were in accord with the above-mentioned "axioms." In this latter paper an explanation is offered for the effects of current density, temperature, concentration, and certain impurities.

One reason for the lack of discussion or application of these axioms by electroplaters is the fact, pointed out by Mr. G. B. Hogaboom in 1913, that few platers could even understand, much less employ them. In order, therefore, to translate these axioms into platers' language and to illustrate their application to electroplating, a number of simple experiments were recently conducted at the Bureau of Standards, the results of which were presented in an informal report to the American Electroplaters' Society at their annual convention in Philadelphia in July, 1919. Since these experiments were conducted as illustrations rather than demonstrations of the various effects, no attempt has been made to refer in detail to the voluminous literature upon the subject. Even though the experiments were primarily pedagogical and in no sense conclusive or exhaustive, it is believed that the results may be of some interest to the Electrochemical Society, and may serve to invite discussion of these axioms or other principles of electrodeposition. If some such principles can be definitely established and accepted as a working basis for research in this field, an economy of time and effort will be effected for both the investigator and the commercial operator.

Principles Involved.

These experiments were largely based upon Prof. Bancroft's axioms, which were stated by him in the following form:

(1) Bad deposits are due to excessive admixture of some compound or to excessively large crystals.

(2) Excessive admixture of any compound can be eliminated by changing the conditions so that the compound cannot precipitate.

(3) Increasing the current density, increasing the potential difference at the cathode, or lowering the temperature, decreases the size of the crystals.

(4) The crystal size is decreased when there are present, at the cathode surface, substances which are absorbed by the deposited metal.

(5) If a given solution will give a good deposit at any current density, it will give a good deposit at any higher current density, provided the conditions at the cathode surface are kept constant.

(6) Treeing is facilitated by a high potential drop through the solution and by conditions favorable to the formation of large crystals.

It should be noted that these axioms are confined to the effect of certain conditions or variables upon the structure of the deposit, and have no direct or necessary relation to the purity of the metal obtained or to the electrode efficiencies or to numerous other factors which may play a very vital part in the success of a plating operation. They are, however, of special interest to the electroplaters, who are concerned principally in the appearance rather than the composition of the finished deposits. From the point of view of the plater we may usually define a "good deposit" as one which is fine grained, since fineness of grain is in general accompanied by a high lustre, relative freedom from porosity, and comparative hardness. In electroplating the structure of the metal may be even more important, since it largely determines the physical properties upon which the durability of the product depends. It is therefore highly desirable to define, if possible, conditions of operation which will produce a fine structure (or which in some cases will permit any change in structure required to produce a desired finish), which conditions should be susceptible of control and should permit favorable opeartion over a considerable range.

In considering the structure of the deposits it is desirable to distinguish between the size and shape of the actual crystals and the structure of the deposit as a whole.

* Manuscript received July 31, 1919.

[1] Published by permission of the Director of the Bureau of Standards.

[2] Trans. Amer. Electrochem. Soc. (1904), 6, 27. Jour. Phys. Chem. (1905), 9, 277.

[3] Trans. Amer. Electrochem. Soc. (1913), 23, 266.

[4] E. B. Rosa, G. W. Vinal and A. S. McDaniel, Bureau of Standards, Reprint 195 (1912).

The latter may be influenced by a number of factors, other than crystal size, which must be included in any comprehensive study of the structure of deposits. In the experiments to be described no attempt was made to determine the causes of pits, ridges, cracking, peeling or numerous other defects which may be encountered in plating, and which are probably due to specific properties of the particular metal or its salts, and hence are less readily subject to generalization.

Outline of Experiments.

In order to obtain information as to the appliability of the proposed axioms, simple experiments were conducted with solutions of nickel, zinc and copper, in which the purpose was not so much to obtain good deposits from the platers' standpoint as to furnish illustrations of the effect of a given variable. In order, therefore, to make the effect of the particular variable pronounced, it was often fixed at a value known to be outside of present good working practice. The effort was made to control conditions so as to confine the effect to one variable. This was not always feasible, since obviously it is not possible, e.g., to change the conductivity of a solution without changing some other properties. It is believed, however, that qualitatively the effects noted were due principally to the factor designated.

It was found most satisfactory to define the concentrations in terms of normality (except for substances such as glue of indefinite molecular weight or constitution). In view of the obvious advantage of this practice in chemical work it would hardly deserve mention were it not for the custom in such investigations (including some previously published by the author) to fix the concentration in grams per liter, selected either arbitrarily as e.g. 200 g/L or with a view to ready conversion to ounces per gallon, thus 45 g/L (6 oz./gal.); or even to use the indefinite term percent. The use of "grams per liter" or "ounces per gallon" is fully justified in expressing the results of an analysis or the formula to be used in preparing a solution, but in conducting experiments the use of normalities is preferable, since it permits a ready conception of the "constitution" and probable behavior of the solution and the role played by any addition. Misconceptions may arise from failure to compute the normalities, especially when substances of low equivalent weight are thus added to solutions containing metals of high equivalent weight. Thus, if a solution is defined as containing 10 per cent. of lead acetate and 5 per cent. of nitric acid, or 100 g/L of lead acetate and 50 g/L of nitric acid, it would appear to consist principally of lead acetate. If, however, the same solution is defined as 0.45 N in lead acetate and 0.79 N in nitric acid, it is apparent that the solution may with even greater accuracy be considered as consisting of lead nitrate with the addition of acetic and nitric acids. In a few cases where there may be uncertainty as to the equivalent weight, as e.g. with organic compounds, confusion may be avoided by stating the molarity rather than the normality.

In order to avoid the introduction of impurities the purest commercial rolled metals were used as the anodes. Owing to the passivity of pure nickel it was necessary to add nickel chloride to the nickel baths to produce adequate anode corrosion, and thus avoid changes in concentration or acidity. In all of the baths a definite appreciable acidity was maintained in order that slight differences in anode and cathode efficiency would not cause appreciable changes in acidity during a run. This was accomplished by the presence of boric acid in the nickel and zinc solutions and of dilute (0.1 N) sulphuric acid in the copper solutions.

In order to avoid any deposition by immersion with its attendant possible effects upon the structure of the deposits, the latter were prepared in each case upon the corresponding metal, e.g., nicked upon nickel, etc. The cathodes were all rolled metal, fairly smooth and uniform, so that the deposits obtained in any case are comparable with other deposits of the same metal. Except for cases that will be cited, all deposits were made of the same thickness (0.025 mm. or 0.001 inch), since otherwise the size of the crystals would not be comparable. This thickness was selected as representing a fair average for most electroplating. More pronounced differences would no doubt be obtained with thicker deposits, especially if cross sections were to be studied. The details and results of the various experiments will be considered from the standpoint of operating factors rather than in the order suggested by Prof. Bancroft.

RESULTS OF EXPERIMENTS.

A.—Current Density, Concentration and Agitation.

In discussing the effect of current density it is convenient to combine Axiom 5 with part of Axiom 3 in the following statement: "Increasing the current density decreases the size of the crystals. If a given solution will give a good deposit at any current density it will give a good deposit at any higher current density, provided the conditions at the cathode are kept constant." Since the current density determines the rate of deposition and consequently the output of a given plant, great stress is usually laid by the platers upon "rapid solutions," i.e., those which will permit high current densities. To many platers the first part of the above statement appears incorrect, since it is well known that upon increasing the current density above a certain value the deposits become coarse and spongy with the characterisic "burnt" appearance. This effect, usually due to the co-precipitation of hydrogen, may properly be considered as an illustration of Bancroft's first axiom, that "bad deposits are due to excessive admixture of some compound," provided that in it we substitute "substance" for "compound." In order to illustrate the effect of increasing the current density under normal conditions, deposits were produced at current densities from 0.2 to 3 amp./sq. dm. (1.9 to 28 amp./sq. ft.), in the following solutions, which served as "standard" solutions for purposes of comparison. These solutions are in no sense suggested as commercial standard plating solutions, but were absorbed merely as simple solutions from which good typical deposits could be obtained.

(1) Copper sulphate N (125 g/L or 17 oz/gal)
Sulphuric acid 0.1 N (4.9 g/L or 0.7 oz/gal)

(2) Zinc sulphate N (144 g/L or 19 oz/gal)
Boric acid 0.1 M (6.2 g/L or 0.8 oz/gal)

(3) Nickel sulphate 0.8 N (112 g/L or 15 oz/gal)
Nickel chloride 0.2 N (24 g/L or 3.2 oz/gal)
Boric acid 0.1 M (6.2 g/L or 0.8 oz/gal)

It was shown that with copper the effect of increasing the current density from 0.2 to 2 amp./sq. dm. was to produce a marked decrease in the size of the crystals. A further increase to 3 amp./sq. dm. produced no appreciable

change in the crystal size, but tended to produce a porous or "burnt" deposit.

With zinc also the effect of increased current density is to diminish the size of the crystals. Roughness is characteristic of zinc deposits produced from sulphate solutions at relatively low current densities, and is probably connected with the fact that under such conditions bubbles of hydrogen are liberated slowly and cling tenaciously to the zinc surface.

With nickel also the same beneficial effect of increased current density, exemplified by a deposit of 2 amp./sq. dm., which were very bright and almost non-crystalline. The characteristic curling and cracking of nickel at higher current densities is no doubt due to the increased occlusion of hydrogen.

Having shown that, under any given conditions, an increase in current density up to a certain point decreases the size of the crystals and therefore (for most purposes) improves the deposit, it is important to determine by what means this critical current density can be increased. Since this point is probably that at which hydrogen evolution becomes excessive, because of local impoverishment of the solution, it is obvious that either an actual or a local increase in metal concentration will reduce the tendency toward spongy deposits; in other words, the conditions at the cathode will be kept more nearly constant. The simplest way to maintain the metal concentration at the cathode is by means of agitation such as is produced commercially by compressed air or by mechanical means. If the result of such agitation is to increase the effective concentration of the metal, its influence (at any given current density) should be much more marked in a dilute than in a concentrated solution.

To test and illustrate this point, deposits were produced in solutions which were respectively twice, and one-half the concentration previously employed, at a current density of 1 amp./sq. dm. (9.3 amp./sq. ft.), in (a) still solutions, (b) those agitated with compressed air, and (c) those with mechanical agitation produced by rotating a glass stirrer between the anode and cathode.

From these results it was seen that with all three metals agitation of dilute solutions produces much smoother deposits than are obtained in still solutions, while with the more concentrated solutions (at the current density employed) agitation produces no marked improvement except in the case of zinc. Here the removal of the ridges by the agitation is probably due to the sweeping away of bubbles of hydrogen. No consistent difference was observed between the effects of air and mechanical agitation. In some solutions, however, the use of air for this purpose may be objectionable, as was found to be the case in lead fluoborate solutions. In view of the marked advantages of agitation in permitting higher current densities, especially with dilute solutions, it at first appears surprising that so much plating is conducted in still solutions. One objection to agitation is the stirring up of sediment, which causes roughness. In barrel plating this effect is counteracted by the burnishing action produced by the agitation. In many mechanical plating devices a fair degree of agitation is secured without stirring up the sediment. A more general application of agitation in commercial plating seems highly desirable.

B.—Temperature.

In order to determine the effect of temperature upon the structure, deposits were produced in the original ("standard") solutions at a current density of 1 amp./sq. dm. (9.3 amp./sq. ft.) at 25° C. (77° F.) and 65° C. (149° F.).

The results confirm in every case the statement of Prof. Bancroft, that "lowering the temperature decreases the size of the crystals." In every case the deposits at higher temperatures gave a coarser crystalline structure, least marked with nickel. This conclusion seems at first to be at variance with the experience of platers, many of whom employ hot solutions to obtain smoother deposits. Where hot solutions are advantageous it is probably due to other causes such as (a) an increase in the solubility of the salts, (b) an increase in the conductivity (and consequent decrease in the tendency to treeing), or (c) a decrease in the occlusion of hydrogen by the deposit (e.g., with nickel). This is a good illustration of the fact that the actual effect of a change in any condition may be and usually is a result of numerous factors, which may entirely counteract or mask the effect of the variable being studied. The true effect of the increased temperature upon the size of the crystals may be due in large part to an actual or effective increase in the metal ion concentration, brought about by a greater degree of dissociation and by increased mobility at the higher temperature.

C.—Conductivity.

In plating operations stress is frequently laid upon the conductivity of solutions and upon the use of various "conducting salts." Since the addition of almost any salts to such solutions will increase their conductivity, any such additions might be, and frequently are, designated as "conducting salts," although their beneficial effects may be due principally to a change in properties other than conductivity. The obvious advantage of an increased conductivity is the reduced voltage necessary to obtain a given current density. Apart from this economic advantage it is not at first evident why a well-conducting solution should produce, at a given current density, a better deposit than one with poorer conductivity. Bancroft's sixth axiom, that "treeing is facilitated by a high potential drop through the solution," suggests the advantage of increased conductivity, since at a given current density a high potential drop through the solution is due to low conductivity. If therefore two solutions could be prepared in which only the conductivity differed, this axiom could be readily tested and illustrated. Actually it is not possible, however, to change the conductivity of a solution without changing some other properties, e.g., the metal ion concentration. Thus, in a copper sulphate solution the conductivity may be greatly increased by the addition of sulphuric acid, which, however, through the influence of the common ion, decreases appreciably the copper ion concentration. Since, however, the increase in conductivity produced by the sulphuric acid is many times as great as the decrease in metal ion concentration, it may be assumed, as a first approximation, that the effect obtained is due principally to the increased conductivity. As it is impossible to obtain good deposits from zinc or nickel solutions containing much free acid, sulphuric acid could not be used to increase their conductivity. Sodium chloride was therefore added to these solutions for this purpose. The use of sodium chloride in such amounts was desirable merely for experimental purposes, and cannot be recommended for practical work so far as any existing evidence shows. The solutions of each metal, described in Table I., were run in series until marked trees were obtained in one bath.

Table I.—Resistivity of Solutions.

	Resistivity at 25° C. (77° F.) Ohms.
1 (a) Copper sulphate N	
(b) Copper sulphate N Sulphuric acid 0.1 N	22.4
Sulphuric acid 1.1 N	4.9
2 (a) Zinc sulphate N Boric acid 0.1 M	32.1
(b) Zinc sulphate N Boric acid 0.1 M Sodium chloride N	10.5
3 (a) Nickel sulphate 0.8 N Nickel chloride 0.2 N Boric acid 0.1 M	25.8
(b) Nickel sulphate 0.8 N Nickel chloride 0.2 N Boric acid 0.1 M Sodium chloride N	9.5

The results for copper and zinc illustrate very clearly the decreased tendency to treeing in solutions of high conductivity, and fully confirm Bancroft's statement. It should be noted that while the addition of sodium chloride in large amount to zinc solutions reduced the tendency to treeing, it produced a poor, spongy deposit. No definite trees of nickel were obtained in these solutions under the conditions employed, although the deposits were much smoother in the solutions containing sodium chloride.

D.—Metal Ion Concentration.

Bancroft's axiom that "increasing the potential difference at the cathode decreases the size of the crystals" may be restated for practical purposes that "decreasing the metal ion concentration decreases the size of the crystals." This form of statement is based upon the usual assumption that the potential between a metal and its solution is a measure of the metal ion concentration of the solution. The two most practical methods of decreasing the metal ion concentration without changing the total metal concentration are by the addition of a common ion, and by the formation of a complex ion. Unfortunately with the first method only a relatively slight change in metal ion concentration (e.g., 10^{-2} or 10^{-3}) can be produced in concentrated metal solutions, owing to the limited solubility of the salts that might be added. On the other hand, the formation of a stable complex ion usually results in a very low metal ion concentration (generally less than 10^{-8}). Consequently there is a very wide range between these two ion concentrations, which can be studied only by a careful selection of less stable complexes. If, however, the same qualitative effect is observed in each case, and if the effect is more pronounced at very low metal ion concentrations, it may be safely assumed as a first approximation that intermediate structrue would be obtained with intermediate ion concentrations.

In order to obtain typical illustrations of the effect of relatively slight and very considerable reductions in metal ion concentration, deposits were produced at 1 amp./sq. dm. (9.3 amp./sq. ft.) in the following solutions:

(a) "Standard" solutions (p. 366).

(b) "Standard" solutions + N sodium sulphate.

(c) Normal double cyanides.

The solutions in (c) had the same metal content as in (a) and (b), and contained in each case a slight excess of sodium cyanide.

The results show that in every case the addition of N sodium sulphate caused an appreciable decrease in the crystal size, and that with copper and zinc the formation of a complex cyanide produced a much greater change. With the nickel solution no deposit of nickel could be obtained under the cyanide conditions employed. That these effects are due to reduction in metal ion concentration is indicated by the following approximate[5] values of the single potentials for copper measured in various copper solutions. There is no reason to doubt that similar changes in potential and metal ion concentration were produced in the other solutions.

Table II.—Potentials of Copper in Various Solutions.

	Potential	Copper Ion Concentration Normality
1. $CuSO_4$ — N	+0.308	0.11
2. $CuSO_4$ — N H_2SO_4 — 0.1 N	+0.304	0.09
3. $CuSO_4$ — N H_2SO_4 — 1.1 N	+0.296	0.06
4. $CuSO_4$ — N H_2SO_4 — 0.1 N Na_2SO_4 — N	+0.285	0.02
5. CuCN.NaCN — 0.5 N	—0.316	0.0221

It will be noted that the results shown above neither prove nor contradict the possibility pointed out by R. S. Dean and M. Y. Chang,[6] that in order to produce a fine-grained it is necessary to have present not only a low metal ion concentration, but also another more negative metal (considering the potential of zinc as negative), such as the alkalis or alkaline earth metals. As these were present in all the above solutions of low metal ion concentration, the results obtained may or may not have been influenced by the alkali metals.

In the above-cited experiments of Dean and Chang, a comparison was made between deposits of copper produed in a solution of copper acetate-tartaric acid and in the same solution containing sodium sulphate. Similar experiments were made with solutions of normal cadmium chloride containing sodium chloride, and tenth normal cadmium chloride. There is no indication, however, that these deposits were produced at equal current densities; in fact it is stated that with copper the potential across the cell was maintained at 3 volts, and after the addition of sodium sulphate the electrolysis was carried on under identical conditions. If, as appears probable, the voltage and not the current density was regulated, it is obvious that, owing to the better conductivity of the solutions containing alkali metals, higher current densities were secured, and naturally, therefore, finer deposits were produced.

It is evident that further work is required to determine with certainty the effect of other factors introduced incidentally with the change in metal ion concentration.

In considering and explaining to platers the apparent anomaly that for fine-grained deposits a high metal concentration, but a low metal ion concentration is desirable, it was found convenient to consider the former as a reservoir from which a small but constant supply of material available for crystal growth is furnished. Viewed from this standpoint, we can readily conceive that if the supply of metal ions is large, those crystals which through favorable size or position receive a higher current density will be able to grow more rapidly than the less-favored crystals. If, on the other hand, the supply of ions is restricted, less opportunity will be afforded for excessive

[5] Measured against a normal calomel electrode but expressed in terms of the normal hydrogen electrode, assuming the value +0.286 for the normal calomel cell, and assuming that normal copper sulphate is 0.11 N in copper ion concentration.

[6] Chem. Met. Eng. (1918), 19, 83.

growth of a few crystals. That the production of a coarse-grained deposit is actually accompanied by the "crowding out" of small crystals by larger ones is evident.

E.—Colloids and Reducing Agents.

In spite of the many references to and applications of "addition agents" in plating solutions, no clear distinction has ever been made between colloids and reducing agents, especially in the case of such organic substances as glue or gelatin, which, no doubt, possess both colloidal and reducing properties. Bancroft's statement that "the crystal size is decreased when there are present at the cathode surface substances which are adsorbed by the deposited metal," evidently includes the effect not only of colloids, but also of such reducing substances as are adsorbed, or give rise to the formation of substances that are adsorbed. Wherever a substance has definite colloidal properties it appears probable that they will account for its effect in reducing the size of the crystals, especially since exactly similar, though usually less-marked, effects can be produced by the use of inorganic addition agents such as salts of aluminium and tin, which readily hydrolyze with the formation of colloids.

The function of reducing agents in plating baths has never been clearly defined, and many statements in the literature are contradictory. Assuming that the deposit will be improved in some way by the presence in the solution of a reducing agent, the effect of relatively large amounts of such substances as glucose can be accounted for. On the other hand, it is very difficult to explain, on the basis of reducing action alone, the marked and relatively persistent effect of very small additions of such substances as pyrogallol, which, if they were required to cause appreciable reduction at the cathode, would be themselves rapidly oxidized. It therefore appears probable that, in many cases at least, the effect of reducing substances may be due to the formation, either directly or under the influence of the current, of colloidal particles of metal or of secondary products of decomposition of the organic substance. Thus, in the case of silver nitrate solutions, it was found[7] in a study of the silver voltameter that small amounts of both inorganic and organic reducing substances such as hydrazine, hydroxylamine, dextrose, aldehydes, phenor, hydroquinone and filter paper extract, all had the same effect, viz., a diminution in the size of the crystals and the formation of striations. In all of these cases it was concluded that the effec was due to the formation of colloidal silver, the presence of which in the deposit accounted for the excessive weight of deposits from contaminated solutions.

It was not possible in connection with the preliminary experiments here described to make any actual study of the effect of various colloids or reducing substances. In order to illustrate, however, that qualitatively their effects are similar, experiments were conducted in which respectively glue (0.5 g/L) and glucose (0.2 M or 36 g/L) were added to the "standard" solutions. The results showed that the effecs are in the same direction but are usually much more marked with glue than with glucose. The deposit of nickel from the solution containing glucose was of special interest, as it was very bright and smooth. On the other hand, no satisfactory deposit of nickel could be obtained from solutions containing even as little as 0.2 g L of glue. The deposits were bright but very brittle, and possessed almost no coherence. The deposit from the zinc solution containing glue was very bright but was covered with nodules and pits.

These results indicate that a great amount of research will be required before any systematic classification of the effects of colloidal and reducing substances in electrodeposition can be effected. With present knowledge it is almost impossible to predict with any probability the effect of any given addition agent in a particular solution.

Conclusions.

From the above-described experiments it may be safely concluded that for the common metals and over a considerable range of conditions, the axioms of Bancroft are applicable. As opportunity offers it is hoped to conduct more exhaustive experiments in which the relative magnitude of the various effects for any given metal may be determined. From such studies it should be possible not only to define favorable operating conditions for plating baths now in commercial use, but also to suggest modifications which will permit more rapid or more satisfactory operation. By a study of the literature in the light of these axioms, accompanied by suitable confirmatory experiments, it should be possible to explain or eliminate some of the apparent contradictions in the literature of electroplating. Both chemists and platers will render great service by calling attention to apparent exceptions to these axioms, in order that is such exceptions are found to be valid, the "axioms" may be modified or added to, so as to include such cases.

Recommendations.

It should be borne in mind that even if the above axioms should be proved to be universally applicable (as is obviously not yet the case), there would still be a wide opportunity for research in the field of electrodeposition. As previously pointed out, the actual effect of any intentional or accidental change in operating conditions is almost invariably a result of a number of causes, sometimes working in opposite directions. Before it is possible, therefore, to define the best working conditions for any specific plating operation or to predict the effect of a given change, it is necessary to determine not alone the direction (which for most cases may be indicated by Bancrofts axioms) but also the magnitude of each effect for a particular metal or solution. In addition it is necessary to study those specific properties of the metals or solutions which may exert effects independent of the above or any similar generalizations. Finally, even after favorable operating conditions are defined, it is essential to develop simple methods of testing solutions and deposits, in order that such conditions may be maintained.

In view of the large field still to be studied, it would be premature to formulate any detailed general operating conditions with the idea that they would be actually applicable in every possible case. Nevertheless it appears desirable at this time to restate, in the form of suggestions rather than advice, to platers and others interested in plating, the general principles which will probably govern the choice of operating conditions. It is recognized that these suggestions by no means cover all the problems of electroplating, and that they should be used only as a guide, and with care and discretion. Probably their chief value at this time will be not be so much in developing any radical modifications or new solutions, as in indicating the direction in which any desired improvement in existing operations may be sought. Where examples

[7] E. B. Rosa, G. W. Vinal and A. S. McDaniel, Bureau of Standards Reprint 195.

are given, they are used solely as illustrations of the particular factor and are not intended as directions for that particular solution. Where information is lacking the need is indicated.

A.—Composition of Solutions.

(1) *Choice of the Metal Salt.*—For purposes of discussion we may consider the metal salt as the compound present in the solution which contains the major part of the metal to be deposited, *e.g.*, copper sulphate, zinc chloride, sodium silver cyanide, etc. It is, therefore, immaterial (except from the standpoint of convenience and economy) whether the salt is purchased and added as such or whether it is formed in the solution. Thus a solution of sodium silver cyanide may be prepared from either silver cyanide or silver chloride, the only difference being that in the latter case the resultant solution contains in addition an equivalent amount of sodium chloride. In some cases the electrolyte may be composed of nearly equivalent quantities of two metal compounds, as when the zinc oxide is dissolved in sodium cyanide, forming sodium zinc cyanide and sodium zincate.

The compound selected (or its solution) should have as many as possible of the following properties. It should be borne in mind that the actual choice is almost invariably a compromise. Where some of the desirable properties are lacking they may be supplied by appropriate additions to be considered later.

(a) High solubility in order to yield a high metal concentration.

(b) Good conductivity.

(c) Stability, *i. e.*, resistance to hydrolysis (formation of basic salts), and to oxidation or reduction.

(d) A low metal ion concentration, such as is possessed by complex cyanides.

(e) The ability to corrode the anode nearly quantitatively. This is required especially for metals such as nickel which have a tendency to anode passivity.

(f) Good throwing and covering power. The conditions which determine the "throwing power" of a solution have never been clearly defined and are in need of study. They are, no doubt, closely connected with the conditions which determine the crystalline structure.

(g) A sufficiently low price to permit economic operation in the light of its relative advantages.

(2) *Additions to Solutions.*—It has been frequently maintained that the simplest solution is the best plating solution. Consideration of the principles discussed in this paper shows clearly that this is by no means always or usually the case, and that certain additions to solutions produce marked improvement. On general principles, however, and in view of the desirability of using solutions that can be readily analyzed and controlled, it cannot be too strongly emphasized that no additions to plating solutions should be made unless their presence has been shown by experiment to be distinctly beneficial in one or more respects. In this connection it is important to note that by the methods of preparation of solutions frequently employed, substances other than the major metal compound are often produced in the solution. Thus sodium chloride by the solution of silver chloride in sodium cyanide, sodium carbonate by the solution of copper carbonate in cyanide, and sodium hydroxide by the solution of zinc oxide in cyanide. Whether in any particular case the presence in such amounts of the compounds thus formed is an advantage or not, can be determined only by investigation. It is manifest, however, that if their presence is desired, it is immaterial whether they are added to or produced in the solutions. Thus, there is no advantage, other than possible convenience or greater purity, in substituting a metal cyanide for a carbonate and then adding an alkali carbonate to the solution. Where, as in the case of copper, a change in valence is required to produce a cyanide solution, the use of a metal cyanide, or else of a reducing substance cheaper than sodium cyanide, is desirable.

It should be noted that frequently a given addition may accomplish several purposes and in other cases it may improve one property at the expense of another. Wherever it is possible to accomplish several purposes with one substance, it should be used rather than several different substances. Among the purposes for which substances may properly be added to a solution are the following:

(a) To increase the solubility either of the metal salt or of the oxides or basic compounds that may be formed. Thus the addition of sodium chloride increases the solubility of nickel sulphate, and the presence of sulphuric acid in a copper sulphate solution prevents the formation of basic copper or insoluble cuprous compounds. Similarly the presence of excess cyanide prevents the precipitation of insoluble cyanides.

(b) To increase the conductivity. This may be accomplished by the addition of an acid to acid solutions, and of a well-conducting salt to solutions which must be kept nearly neutral.

(c) To regulate the acidity or more specifically the hydrogen ion concentration of such solutions as zinc and nickel, which must not have excessive acidity. For this purpose weak acids (or their salts) may be used, such as acetic and boric acids.

(d) To reduce the metal ion concentration. In the case of simple solutions this may be effected by the addition of a salt with a common ion, *e. g.*, sodium or potassium sulphate to metal sulphate solutions. If we consider a complex salt, such as a double cyanide, as the major compound, it already has a low metal ion concentration which can be further reduced by the addition of an excess of cyanide.

(e) To aid anode corrosion and decrease the polarization resistance. For example, the addition of nickel chloride or alkali chlorides to a nickel sulphate solution and the addition of hydroxides or cyanides to an alkaline zinc solution.

(f) To increase the throwing power. As previously stated, this property has never been thoroughly studied.

(g) To form colloids (or other dispersoids) which will migrate to the cathode and reduce the size of the crystals. These may be added directly in the form of glue, gelatin, casein, albumen, etc., or in the form of substances which will yield colloids by hydrolysis or reducing action.

(h) To exert a reducing action at the cathode or in the solution. This may possibly be associated with (g).

(i) To yield ions of a more negative metal (such as sodium, potassium, magnesium, etc.). Whether this effect is connected with (d) has not been definitely determined.

B.—Current Density.

The highest current density should be employed that will yieldyield satisfactory deposits (unless it is intentionally desired to obtain coarse-grained or soft deposits). The permissible current density may be increased by suitable agitation of the solution, especially the portion of the solution close to the cathodes.

C.—Temperature.

If fine-grained, bright, or hard deposits are desired, the temperature should be kept as low as convenient, if neces-

sary by using artificial cooling. If coarse or soft deposits are desired the temperature may be allowed to rise. Since the effects of increased current density and temperature are in opposite directions, it is possible to obtain in warm solutions at a high current density (which at a given voltage may be more readily secured in warm solutions) as fine deposits as are produced in cold solutions with a lower current density.

SUMMARY.

Experiments have shown that Bancroft's "axioms of electroplating" are applicable over a wide range of conditions and with a variety of metals. They may, therefore, serve as a valuable guide in plating research and in practical plating operations.

In conclusion the author desires to acknowledge his great obligation and appreciation for the services of his associates, especially Zalia Jencks, L. B. Ham, S. C. Langdon, H. E. Haring and L. D. Hammond.

U. S. Bureau of Standards,
Washington, D.C.

(Written discussion of this paper is invited, and may be sent to the Secretary, Jos. W. Richards, Bethlehem, Pa.)

The Chemist in the Paper Mill*

IT was not so very long ago that the paper mill which employed a chemist was a rarity, and the manager or owner of that mill was regarded as a sort of addle-pated philanthropist, or even worse. Gradually, however, conditions changed. Papers which were formerly considered perfectly satisfactory are now pronounced entirely worthless for the printing of certain grades of work; mechanical and chemical wood-pulps and other fibrous raw materials were introduced, and these factors exerted their influence in the same direction, and the result has been that, more and more, paper mills have come to rely upon chemical knowledge for the solution of many of their difficulties. Very fortunately it is now recognized that a chemist can be of some use in a paper or pulp mill, and if he is the right sort, and is given proper support, his services will be of great value.

Testing Supplies and Raw Materials.

The first duty of a wideawake chemist in the pulp and paper mill is to test the supplies, such as sulphur, lime, pyrites, soda ash, bleaching powder, clay, rosin, size, alum, casein, glue, blanc fixe, coal, fuel oil, oils and greases, belting, metals and alloys, etc., so as to see whether the superintendent is getting standard materials to work with.

Changes in Raw Materials.

Going one step further in the manufacture we have the raw materials undergoing changes of all sorts, which have to be watched to see that uniformity is maintained. As an example, consider the case of sulphur which is burned to sulphur dioxide, which is in turn absorbed in milk of lime, or by limestone and water, to form the cooking acid for the sulphite process. This entire process must be carefully watched and constancy of results maintained, for if variations of too great magnitude occur a poor "cook" is likely to be obtained, which may cause the paper made therefrom to be down in color, or tender, or full of shives.

Neither the tests for supplies nor the watching of processes are so cut and dried that they can be done by a man in parrot fashion, otherwise the very points which are likely to lead to improvements, either in methods of testing or in manufacturing, are likely to be overlooked. Sometimes these tests are done by a young workman, selected by reason of apparent ability, but in case of abnormal results he is lost unless he has a well-trained chemist to appeal to.

The Field of Work.

There is no limit to the field of work for the paper-mill chemist, as it includes practically all the problems relating to the determining of the efficiency of processes and the improvements which can be made, and also the investigation of new processes or suggested new materials. There are no beaten paths to follow in most of this work, and the chemist must lay out his own plan of attack.

Scope of the Problems.

This particular semi-research phase of the work is the part which keeps it from being drudgery; if one never knows what he is going to be up against when he goes to work in the morning he has got to be alert and ready to tackle any kind of a problem. A brief review of a few of the problems which have come under the observation of the writer will give a slight idea of the scope of such work. For lack of space these can only be listed by title: Studies of the rosin sizing of papers; greases and graphite lubricants; experiments with acid-proof irons for sulphite work; tests of various fillers; studies of the effect of humidity on papers; investigation of frothing in beaters and coating mixtures; new fibrous raw materials for paper-making; methods of purifying brine; studies of causticizing operations; tests of multiple-effect evaporators; tests of the durability of papers; packings to be used in a sulphite mill; studies of the rate of growth of spruce and poplar trees; investigations relating to the testing and use of casein; examination of defective electrical insulations; studies of pulp-washing problems; tests of efficiency of waterproof wrappers.

This gives but a slight idea of the variety of questions which will be put up to the chemist after he has once established a reasonable reputation. It is really astonishing how much he is expected to know, and anyone is likely to ask him any sort of a question from the best cure for warts up to how to make sulphite fibre without sulphur.

The Qualities and Training Required.

For the routine man (who may be a man taken from among the workmen or a student), honesty, industry and a certain amount of manipulative ability are the prime requisites. He must be honest, for there is no way of checking his results without repeating the tests.

For the second class of work, that including much of a research nature, a very different type of man is needed, and his training must be very thorough and of as broad a nature as possible. Such training can be obtained only in one of the best colleges or universities and usually by the expenditure of four years of time. To employ anyone for such work who has had less training is to invite disappointment, but on the other hand, simply giving the

* Synopsis of article by E. Sutermeister in Paper, organ of the Technical Association of the Pulp and Paper Industry.

work to a college man does not by any means insure its success, since many graduates do not have the necessary qualifications.

It is an unfortunate fact that the average college graduate is a pretty 'green" specimen, and that his training is defective in many ways. If he has a thorough foundation in analytical chemistry, in the properties of the elements and their compounds, and has also a knowledge of where information is to be found and the best means of digging it out, that is about all that can be expected, and it will enable him to build upon a fairly secure foundation.

Ingenuity is a quality which will make any chemist much more valuable. Many times he will be called upon to work out new methods of testing, or to conduct tests under abnormal conditions, and his ability to get results under such conditions will not only give him a feeling of satisfaction in his own accomplishments but will eventually win him promotion. Ingenuity along such lines cannot be attained without a comprehensive knowledge of the apparatus and equipment of the plant.

The Activation of Carbon[1]

A New Viewpoint on the General Nature of Amorphous Carbon, Resulting From a Study of Defensive Methods Against Toxic Gases Used in Warfare

By N. K. CHANEY[2]

Introduction.

THE war has brought into existence, as an article of commerce, a new product known as "activated carbon."

Originated as a means of defense against toxic gases in warfare, this material is rapidly finding industrial applications, the extent and novelty of which are not as yet generally appreciated.

The development of activated carbon represents something more than a mere improvement in older forms of adsorptive carbon, or in older processes. It stands for a new viewpoint as to the general nature of so-called amorphous carbon.

Carbon has been hitherto defined as existing in three distince modifications, diamond, graphite and amorphous. The latter term has comprised a heterogeneous assortment of natural and artificial carbon materials, possessing a variety of widely different physical and electrical properties, such as manifestly could not be explained by a single allotropic modification of elementary carbon.

Thus, while the complexity of so-called amorphous carbon has long been recognized, we are beginning for the first time to obtain a rational idea of its individual components and their relations to one another.

Some of these ideas and relationships have been indicated in a general way in a recent joint paper[3] by A. B. Lamb and the writer.

In other accounts of the work of the Bureau of Mines[4] and of the Chemical Warfare Service[5] are related the circumstances which led the National Carbon Co. to devote its Research Laboratory to the development of a satisfactory adsorbent charcoal for the American Army.

In accepting this problem, contrary to the popular impression, we possessed no special knowledge of vegetable charcoals, or special acquaintance with the processes and literature regarding the preparation of adsorbent and clarifying materials.

We assumed at the start that whatever general knowledge existed in these fields was inadequate to a solution of the problem, otherwise the stress of two years' gas warfare wosuld have brought about solutions of which the Government would have had adequate information. We were strangely ill-informed of the partial success already obtained by England, France and Germany.

Thus the belief that no adequate protection existed against certain toxic gases, and our lack of information regarding the methods and results obtained by others in the field provided the compelling stimulus for a new and fundamental investigation of the first principles of adsorptive activity in carbon.

The result of this intensive research was the gradual development of a broad general conception as to the nature of active carbon and its relations to the generally occurring forms of carbon.

Alpha and Beta Carbon.

This general theory in its complete form rests upon two independent, experimentally established postulates.

(1) That elementary carbon (other than diamond and graphite) exists in two modifications, "active" and "inactive," or *alpha* and *beta*.

(2) That all "primary" amorphous carbon consists essentially of a stabilized complex of hydrocarbons, adsorbed on a base of "active" or *alpha* carbon .

We will discuss these primary postulates in order.

The active modification of carbon is characterized by a high specific adsorptive capacity for gases, etc. The inactive modification carbon exhibits no special adsorbtive capacity whatever.

In addition to this distinction in specific adsorbing power, active and inactive carbon differ in two other mportant particulars, i.e.:

(1) Temperature of formation.

(2) Chemical activity, or susceptibility to oxidation.

The active modification is formed whenever carbon is deposited at relatively low temperatures by chemical or thermal decomposition of carbon-bearing materials; in general below 500 to 600° C.

The inactive modification results from similar decomposition at higher temperatures, in general above 600 to 700° C.

The active form is rapidly attacked by oxidizing agents. Dr. Hulett has shown that slow oxidation occurs at room temperatures. The inactive form is relatively stable toward oxidizing agents, resermbling graphite in this particular.

It would be premature to assert that these two forms of carbon are true allotropic modifications. It is not yet established that both forms are amorphous. Attempts to

Note.—A paper presented at the thirty-sixth meeting of the American Electro-Chemical Society, Chicago, September 23-26, 1919.

[1] manuscript received August 14, 1919.
[2] Research and Development Laboratory, National Carbon Co., Inc., Cleveland, Ohio.
[3] J. Ind. and Eng. Chem. (1919), 11, 420-467.
[4] Bull. 178-A War Gas Investigations. Bureau of Mines.
[5] J. Ind. and Eng. Chem. (1919), 11, Jan. and April number.

find a transition temperature, or to convert *alpha* into *beta* carbon, have been tried without definite success, at temperatures up to 1,600° C.

This much is established. The two forms are characteristically distinct and easily differentiated, both by their properties and conditions of formation.

Hydrocarbons, such as methane, ethylene, benzene, etc., the decomposition points of which are normally above 700° C., in general give only inactive carbon. Hydrocarbons, such as acetylene, which may be cracked at temperatures as low as 300° C., may give active carbon at lower temperatures and inactive carbon at higher temperatures. The temperature at which molecular carbon is set free is apparently the controlling factor in determining whether it is of the active or inactive variety.

The second part of the general theory relates as stated above to the definition of primary carbon as a stable adsorption complex of active carbon and residual hydrocarbons.

Formation of Active Carbon.

In the ordinary process of distillation of carbonaceous materials, at relatively low temperatures, active carbon is first formed by the thermal decomposition of unstable hydrocarbons. By virtue of its specific adsorptive properties this active carbon adsorbs a further quantity of hydrocarbons, and these hydrocarbons are thereby stabilized to a remarkable extent, so that they are retained under conditions of temperature, pressure, etc., at which they would otherwise be quickly eliminated as such, or suffer decomposition.

For example, quantities of a hydrocarbon resembling anthracene, the boiling point of which is 360° C., have been isolated from cedar charcoal which had been previously calcined to 850° C. In the same manner chlorine substitution products of hydrocarbons may be obtained in quantity by pasing chlorine gas at high temperatures over cocoanut or other charcoals which have been calcined to similar temperatures. This illustrates the power of active carbon to stabilize its adsorbed materials.

This stabilized complex of hydrocarbons adsorbed on a base of active carbon is the product which we have defined as primary carbon, because it is the original product first occurring in low temperature distillation of carboniferous materials. Many commercial grades of animal and vegetable charcoal are of this character; as are also such cokes as result from the low temperature distillation of bituminous coals, mineral bitumens, etc.

Anthracite coals may be regarded as native primary carbons, since they have been shown to possess an active carbon base saturated with adsorbed hydrocarbons.

Bituminous coals may be similarly regarded, although their hydrocarbon content is in great excess of the adsorptive capacity of the active carbon base. Such excess may be readily removed by distillation under proper conditions.

Ordinary coke, on the other hand, is heavily charged with inactive carbon resulting from the gas treatment to which it has been subjected, i, e., the decomposition in it of volatile hydrocarbons at high temperatures.

Sudden heating of primary carbons to very high temperatures results in the decomposition of the adsorption complex, and the sudden liberation of its hydrocarbons at temperatures much above their normal decmposition point. The latter then break down, forming inactive carbon deposits upon the active carbon. In this way a primary carbon may become self gas treated.

Thus the carbon products resulting from the gas treating of primary carbon at high temperatures by volatile hydrocarbons, either self contained, or introduced from without, may be properly termed secondary carbon, which thus possesses a variable composition of active carbon, hydrocarbons and inactive carbon, depending upon the extent and conditions of the gas treatment.

Primary carbon is therefore essentially an adsorption complex of hydrocarbons adsorbed by a base of active carbon, with or without associated non-adsorbed hydrocarbons.

Secondary carbon is primary carbon partially or completely broken up with the formation or introduction of inactive carbon, by the high temperature decomposition of its hydrocarbons.

From the above description it is self evident that primary carbons as such will not possess a high specific adsorptive power, the active carbon being saturated by the hydrocarbons adsorbed by it. The process of activation must therefore consist fundamentally in the separation and removal of the hydrocarbons from the active carbon.

Experimental Evidence.

The correctness of the general principles just outlined has been substantiated in a very interesting manner. According to theory carbon deposited at low temperatures and absolutely free from hydrocarbons, should be the purest form of active carbon and require no activating process. Therefore, carbon was prepared from the reaction $2CO = C + CO_2$, at 300° C., using ferric oxide as a catalyst.

The carbon so formed upon removal of the iron proved to have a specific adsorptive capacity appreciably greater than the best samples of active carbon prepared from hydrocarbon sources.

The practical elimination of the hydrocarbons from primary carbon is, however, extremely difficult.

Because of the stability of the adsorption complex, the temperatures required to accomplish this thermally are so high that secondary formation of inactive carbon by self gas treating is inevitable. Prolonged heating for days under carefully controlled conditions will partially accomplish the desired object, yielding an impaired and gas treated product, which contains a small amount of active carbon. To secure even partial success with this method requires specially selected and prepared forms of primary carbon, in which the character of the hydrocarbon content is such that either the stability of the adsorption complex is lessened or the tendency to gas treating is a minimum.

Having independently discovered the essential principles of this method, it was abandoned because of its practical limitations. It was later found that the British and French had developed this method to the commercial stage.

Second Method of Activation.

The second general method of activation suggested by the theory is to attack the primary carbon by some form of selective chemical action.

The most successful of these is differential oxidation. It has been shown that the adsorption complex could be broken down and the hydrocarbons oxidized or partially decomposed and distilled away from the active carbon.

While many forms of oxidation, both wet and dry, gave some degree of separation, and consequent activation, the yield and quality of activated carbon obtained varied greatly with the kind of oxidizer employed and the manner of its control.

Since inactive carbon is highly resistant to oxidation it is essential to the proper practice of activation by controlled oxidation, that the formation of inactive carbon be avoided at every stage of the operation, including the production of the primary carbon itself. At the same time

considerable latitude is permissible for the reason that the tendency to gas treatment varies with the chemical nature of the adsorbed hydrocarbons, i. e., with their decomposition points.

Hydrocarbons present in bituminous coals are found to deposit inactive carbon more readily than hydrocarbons derived from certain other carbon complexes, such as may be prepared from certain woods and nuts. Hence it is that the adsorptive carbon of commerce was hitherto produced only from the latter sources, and not by reason of any inherent impossibility of preparing active carbon from coals, petroleum and other mineral deposits.

The commercial developments of the oxidation principle as worked out by us and adopted by the Chemical Warfare Service, consisted in the air process, the steam process, and later the use of CO_2.

The discovery of the availability of anthracite and natural coals, and the possibility of manufacturing synthetic primary carbon from pulverized materials by the use of the usual binders employed in carbon manufacture, saved us from a critical shortage of nut materials in the later months of the war.

The special forms arising from these developments were known by the Gas Defense as Dorsite made from cocoanut, Bachite made from anthracite, and Carbonite a synthetic product made by carbon manufacturing processes, from lampblack, powdered coal, or other suitable materials.

The underlying principles of the theory as to the nature of primary carbon are strongly confirmed by the fact that two entirely different methods of activation suggested by it, i. e., controlled distillation, and differential oxidation, are in some degree effective.

A modification of the second method is also suggested by the theory, which would consist in the addition of chemical reagents to act catalytically or directly during the primary carbonization to break down the stabilized hydrocarbons at temperatures below the critical range in which inactive carbon is formed.

This method was successfully employed by us to duplicate German war-charcoal, thus indicating the method by which the latter was formed, which consisted in impregnating wood with various metal salts before carbonization, and later extracting with acid. This was afterwards verified by the Army Commission visiting Germany.

The amount of active carbon formed by this method is very small in comparison with the better methods of selective oxidation. On the other hand, the extraction of the dispersed inorganic material leaves a very fine and effective capillary structure capable of adsorbing large quantities of gas at high concentrations of the latter. In this connection it is necessary to explain that we have clearly shown the possibility of differentiating between two types of adsorptive capacity, one due entirely to the arrangement and physical structures of the adsorbent, which we term the capillary capacity, and a second type characteristic of the material of which the adsorbent is constituted. Capillary capacity is distinguished by large capacity at high gas concentrations and by rapid equilibrium between adsorbent and gas phase, in either direction, the gas being removed as readily as it is adsorbed. Specific capacity is characterized by very considerable capacity at low gas concentrations, and by extremely low rate of loss during reversal of the adsorption process.

Thus by saturating an adsorbent and then noting the rate at which different portions of the adsorbed gas are removed, it has been found possible to evaluate the specific and capillary components of the total adsorptive capacity.

The weight of gas retained, after rapid weight loss has ceased, called the "retentivity" of the adsorbent, is a measure, therefore, of the proportion of active carbon present, in a given weight of adsorbent. This test applied to pre-war charcoals shows that their adsorptive capacity is almost wholly capillary and dependent upon the physical structure left by distillation in the primary carbon. In general even this capacity is extremely small compared with present standards.

German charcoal is distinguished by the very high ratio of capillary to specific capacity. On the standard accelerated tube tests employed by the Chemical Warfare Service. German charcoal thus showed up very well because of the high concentrations of gas employed. If one were to breathe through the coal at the end of such a test, however, one would soon inhale 75 per cent. or so, of the gas previously adsorbed. Thus German charcoal received for a time a wholly unwarranted reputation.

Development of the Theory.

We have now outlined a general theory of the nature of amorphous carbon and the principles underlying the successful isolation of active carbon.

As a working hpothesis the conceptions above outlined have proved their worth by enabling us to develop methods for the commercial manufacture of adsorbent and catalytic carbon, of a character unapproached in pre-war charcoals and from a variety of raw materials hitherto considered useless for such purposes.

Upon the chemical side we have provided a new means of attack upon the problems of the structure and constitution of the various forms o amorphous carbon.

The actual development of the two principal conceptions underlying the complete theory was the reverse of the order of exposition. At the outset of the work the fundamental question was why and how adsorbent charcoals differed from other charcoals less adsorbent.

Because of the vital urgency of the problem at that time and the need or haste, we knew that it would be fatal to back a wrong hypothesis. So far as we could learn the following hypotheses were current:

(1) That a special form of hydrocarbon film was left under certain conditions of distillation which was especially active.

In the case of such gases as chlorine which may form substitution products, such a possibility certainly exists even in the light of present developments.

(2) That adsorption depended upon the physical structure of the adsorbent, i. e., the diameter of the capillary pores

As we have seen this actually represents the type of adsorption previously common in adsorbent materials, other than active carbon, but is not the type of specific adsorption desired for effective field protection against low concentrations of toxic gases.

(3) That adsorptive power depended upon the quantity of fixed gases as carbon monoxide, oxygen, etc.

The difficulty with the latter view was that, if true, it suggested no line of attack.

After considering the above we adopted the hypothesis that absolutely pure amorphous carbon would be active, and that the most obvious impurities in charcoals formed by destructive distillation were hydrocarbons.

It was by no means readily accepted by many chemists that ordinary low boiling hydrocarbons could exist as such

in chars which had been heated up to nearly 1,000° C. for hours.

The crucial experiment was therefore the proof that ordinary hydrocarbons resembling anthracene for example could be removed as such from a charcoal previously calcined to 850° C. by simply distilling it in the presence of air at 300° C.

This not only proved the existence of the hydrocarbons, but indicated directly that by oxidation they could be broken down from the adsorption complex. No explanation was forthcoming, however, as to why certain forms of carbon could be activated while others could not.

It was not until work was commenced on coals and artificial carbons that the significance of the decomposition temperature of the carbon was discovered.

This clue cleared up the entire field and provided the explanation for many previous anomalies, as why, for example, artificial carbons taken from the same furnace could, some of them, be activated and others not. Our observation that all forms of retort cokes were wholly inactive and incapable of activation was also explained. The fundamental conditions surrounding the formation of primary carbon, if the latter was to be capable of activation, were thus completely defined.

To sum up, active carbon is essentially a special form of pure amorphous carbon, deposited at low temperatures and free (1) from adsorbed stabilized hydrocarbons which are normally associated with it and which lessen its power of combining with other substances; (2) from inactive carbon formed by gas treating, i. e., by the decomposition of hydrocarbons upon its surface at high temperatures.

It is possible for the first time to prepare intelligently such active carbon on a large scale from whatever sources of carbon-bearing material may be cheapest, or most desirable for the particular purposes in view.

The unique properties of this material both as catalyst and adsorbent suggest that it will find many industrial applications.

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CHEMICAL OPERATIONS AT TRENTON.

The Chemical Products of Canada, Ltd., chemical manufacturers of Toronto, have quite recently announced a considerable measure of expansion in their organization.

Following successful operations in the manufacture of pharmaceutical chemicals not hitherto made in Canada, during the last two and a half years this company, which will now be known as the Chemical Products Corporation, Ltd., will occupy the plant of the British Chemical Co., Trenton, Ont. Machinery and apparatus are being installed at the present time, and the purpose of the company is to expand the number of lines manufactured, and increase the quantity of the production. It is expected that this will make possible a very much larger amount of business in Canada, and also will allow Canada to go into certain foreign markets in pharmaceutical products in a way which has never yet been done.

Products made by this company are deserving of the strongest support of the Canadian trade, and there is every reasonable assurance that the company will build up a most important and large chain of new chemical industries for Canada.

RESEARCH ON SULPHUR.

All the sulphur companies are anxious to expand the present uses of sulphur, and desire the co-operation of all users. In particular, the Texas Sulphur Co. now wishes to co-operate with experimenters along these lines. Anything that will increase knowledge regarding the properties or uses of an element is something that should be encouraged. We may not hope to learn everything about anything in a few years, and occasionally some forgotten element springs to attention. Even crude sulphur is 99.5 per cent. pure. Some of the well-known properties of this element may yet become the basis of new uses. These known properties upon which to build are M.P. 114.5°C or 238.1°F, B.P. 444.5°C or 832.1°F, sp. gr. 2.05; good resistance capable of shedding water; transient physical form.

With these, the low prices makes it a fit element upon which to base much future industrial research.

REGULATING DRUG IMPORTS.

The fact that importations of cocaine and opium in particular have greatly increased during the last five years, has stimulated an interest in Canadian regulations regarding these products. In May, 1911, the present Opium and Drug Act was passed. It dealt with cocaine, morphine, opium, eucaine and salts, or compounds of these drugs. This left the business of importing and using these drugs in the hands of doctors and qualified druggists.

On May 14, 1919, an order-in-council was passed under the War Measuers Act, whereby the importation of cocaine, opium, opium alkaloids and salts was prohibited, except under license issued by the Minister of Trade and Commerce. Exportation was also regulated by this Department.

The Bill now going through the House at Ottawa is designed to continue the business of importing and exporting these drugs under license at such time as the War Measures Act is annulled.

The Bill, which at this time has had its first reading, is as follows:

"That it is expedient to provide that every person who imports into or exports from Canada and coca leaves, cocaine, or any of their salts or preparations, or any opium or its preparations, or any opium alkaloids or their salts or preparations, without first obtaining a license therefor from the minister who is presiding over the Department of Health, shall be guilty of an offense, and shall be liable upon summary conviction to a fine not exceeding one thousand dollars and costs, or to imprisonment for a term not exceeding one year or to both fine and imprisonment, and that these provisions shall be read as one with the Opium and Drug Act, chapter 17 of the Statutes of 1911, and anything in the said Act which is inconsistent with this resolution be repealed."

B. C. NITROGEN TO JAPAN.

Recently the first shipment was made of nitrogen from the plant of the American Nitrogen Products Company, at Lake Buntzer, Burrard Inlet, British Columbia, to a foreign port, when a large order was consigned to Japan. The shipment was really an experimental one, but good orders are expected to follow. About $500,000 has been invested in the plant, which has been producing for the local market for a short time. It is claimed by the company that good shipping facilities and cheap power makes it possible for them to compete with any company on the Pacific Coast so far as price is concerned.

The Dyeing of Leather*

Different Kinds of Tannage---Dyeing Properties of Leather---Formulas for Different Colors---Bronze and Marbled Effect---Leather Finishes

OWING to the relation that the kinds of leather and the tannages employed have to the ultimate choice of dyestuffs used, it will be well to discuss briefly the sources of and methods of dyeing the various leathers. Leather may be roughly divided into two groups: the covering of the smaller animals, such as the sheep, calf and goat, which are termed skins; and those of the larger animals, the cow, steer and horse, which are called hides.

Sheepskins are mainly used for the manufacture of gloves, cheaper grades of pocketbooks, bookbindings, etc.; goatskin for kid shoes, and for the so-called morocco binding for books, also in the production of patent leather. Calfskins have their main use for the better grades of shoes, generally being chrome tanned. Cowhides find their greatest use as sole leather, belting and harness leather; and, since the advent of the splitting machine for shaving off even thicknesses, they are used in the shoe business as an imitation of calfskin. Horsehide is used for the production of harness leather, shaving strops, etc.

Tannages.

The tanning of skins, which bears such an important relation to the dyeing, can be divided into two branches: vegetable tannage, and the mineral or chemical tannage. Vegetable tannage is the oldest. While a distinct division is made between vegetable and chemical tannages, yet even in the vegetable tannage it is really a chemical change, which converts the skin to leather, as the tannic acid, which is the main constituent of all vegetable tannins, unites chemically with the gelatin held between the fibres of the skin or hide to form a leather.

The vegetable tannins of most importance are sumac, quebracho, oak, hemlock, gambier, mimosa bark and valonia.

Chemical or Chrome Tannages.

The method of tanning skins by chromium compounds was discovered by Robert Foerderer, of Philadelphia, in 1890. This is a distinct chemical process, whereby an insoluble basic chromium sulphate is formed of the fibre of the skins. This process greatly altered the industry, as this method can be completed in six to eight hours, whereas the vegetable tannin required as many days for the lightest skins. Chrome tanning is generally done either by the one-bath method with chrome sulphate or by the two-bath method with bichromate of potash and hydrochloric acid in the first bath, reducing with hydrosulphite of soda in a fresh bath. The advantages of this process are the better wearing qualities of leather so tanned, it being more uniform and less sensitive to high temperature.

Alum Tannage.

Alum tannage is a process whereby the skins are converted into leather by means of alum and common salt. To obviate the disadvantage that all the components used are readily soluble in water, the skins are now most generally given a preliminary treatment with either a vegetable tannage such as gambier, or a semi-tannage with chrome, previous to the alum tannage. After being struck through with gambier, the skins are tanned with a mixture of 5 per cent. alum, 20 per cent. common salt, 14 per cent. flour, and 4 per cent. dried egg yolk. This produces a very soft leather, much used for the manufacture of gloves.

Dyeing.

There are two methods of dyeing: brushing a solution of the color on the leather, or by drumming in the paddle-wheel. The latter is the best, as larger quantities of leather may be handled, the results are more uniform, and better penetration of the leather is obtained. Where only the grain of the leather is to be dyed, or where a ground shade is dyed in the drum and a different color is wanted on the grain to complete the effect, the brushing method is preferable.

Dyestuffs Employed.

The dyestuffs employed for leather dyeing are divided into six distinct groups, namely:

(1) Basic colors, which have their greatest use in the dyeing of vegetable tanned leather or on chrome leather with a mordant of some tannin-containing material. They are also used in the coloring of a great many leather finishes and polishes.

(2) Acid colors, which may be applied to either vegetable or chrome leather, and have great penetrating powers.

(3) Direct colors, known to the trade as diamine, or naphthamine colors, and benzo colors, which are mainly used on chrome-tanned leather, and in some instances on vegetable-tanned leather.

(4) Mordant colors, such as alizarine colors, chrome or anthracene colors. This class is seldom used, owing to the fact that most colors of this group require a boiling temperature to develop the shade, a process which is impossible in the case of leather. A few of them, mostly the yellows, have been successfully employed on chrome leather and yield shades that are extremely fast to light.

(5) Dyestuffs which are diazotized and developed on the fibre, such as Primuline, Diamine Black BH, Diazine Black H, etc. This class of colors is used only on chrome leather, and while fancy shades may be dyed by this method, it is seldom used except for the production of blacks, which yield full blacks on ooze leathers.

(6) Sodium sulphide colors, Immedial, Thion, sulphur colors. These colors are only applied on chamois leather, the uses of which make it essential that the coloring matters employed should be fast to washings.

Other types of colors are the oil colors, such as the cerasine colors that are employed a great deal in the coloring of the waxes used in the finishing of leather. All of these colors and their applications will be more fully taken up under the special classes of leather.

The Dyeing of Chrome Leathers.

As before stated this kind of leather is made by a strictly chemical process. On chrome leather all three classes of colors are used, namely, basic and direct, and these are chosen with the fastness of the ultimate shade in mind. The acid colors, which may be dyed directly without the addition of tannin materials, are the ones which yield the most level shades, have the greatest penetrating powers, but are poor as a rule to fat-liquor. If

* From article by Louis G. Hayes in Color Trade Journal, New York, October, 1919.

these colors are given a topping in a fresh bath with basic colors which form a lake with the acid colors they are then much faster to the acid fat-liquoring process. The acid colors most frequently used are as follows:

For Yellow: Tartrazine, Fast Light Yellow 2G, Milling Yellow O, Azo Yellow, Metanil Yellow, Resorcine Yellow, and the Tropaeoline brands.

For Orange and Brown: Orange II, Orange GG, Croceine Orange, Tropaeoline, R.N.P., Acid Brown D, Havana Brown S, or Resorcine Brown. For brown, combinations of yellow, orange, and Napthol Blue Black.

For Red: Fast Red A, Bordeaux B L, Wool Red B, Napthol Red C, Ponceau and Brilliant Croceine, and Azo Rubine.

For Blue: Solid Blue R, Brilliant Milling Blue B, Soluble Blue, and Nigrosines, Blue shade water soluble.

For Green: Acid Green extra concentrated, Brilliant Milling Green B, Napthol Green B, and Cyanole Fast Green G.

For Violet: All brands of Acid Violets and Formyl Violets.

For Black: None of the Acid Blacks yield what may be called a really full black on chrome leather, serving only as a bottom color or as a shading color. The ones most frequenty used are Napthol Black, Napthol Blue Black and Napthylamine or Alizarine Black. Nigrosine jet shade yields, however, a good black but is not very fast to alkalies. Most tanneries are still much in favor of having a vegetable tanning material on the skin as it undoubtedly assists in producing a better leather. This material, which is generally sumac and gambier for light shades and logwood and fustic for heavier shades, may be applied either before or after the dyeing operation.

The diamine colors, benzo or naphthamine colors, have come into importance for use on chrome leather, and recently they have been recognized as producing full, bright shades which have exceptionally good fastness to light and rubbing. These properties are accentuated by an after-treatment with chromium compounds or bluestone (copper sulphate).

Besides producing fancy shades of very good fastness, the direct black are fast replacing logwood and the basic blacks for the production of blacks on both chrome-tanned calf and goat skins. The dyeing operation is measurably shortened and the shades are far faster to light.

The direct colors of most importance for this leather are:

For Yellow: Diamine Fast Yellow B and FF, which are the same as Napthamine Yellow NN and BN, Chrysophenine, Diamine Fast Yellow A, which corresponds to Stilbene Yellow.

For Orange: Diamine Orange G, Toluylene Orange, and for extremely fast shades, Diamine Fast Orange EG and ER.

For Red: Congo Red, Benzo Purpurine . When these two colors are used the leather should be very carefully neutralized as they are very sensitive to acids. Also, Diamine Fast Red F and 8BL, Diamine Fast Bordeaux.

For Browns: Diamine Brown G and 3G and all the Diamine Catechine brands. Napthylamine Brown 2GX, Erie Fast Brown 3RB.

For Blue: Diamine Blue 2B, Diazine Black, Diamine Fast Blue FFB and Naphthamine Brilliant Blue G and R.

For Green: Napthamine Green AG and AB yield full deep greens.

For Black: The Oxydiamine Black brands. When dyeing with the direct colors special attention should be given to the perfect neutralization of the skins, as most direct colors are precipitated by an excess of acid and work much better in a slightly alkaline dyebath.

These colors exhaust excellently, produce shades which, compared with the acid and basic colors, are extremely fast to light, and, when topped with basic colors, produce shades which have the brilliancy of direct basic dyes with the fastness much improved. As stated under the acid colors, tannin is very frequently used, but in the case of direct colors it should be applied after the dyeing. The tannins retard the dyeing of these colors, and therefore the dyebath is not thoroughly exhausted, with the resultant loss of dyestuffs.

The basic colors have little or no affinity for chrome-tanned leather, and are never used for self-shades without previously retanning the skins with a vegetable tannin chosen with due regard to the shade desired. A vegetable tannage is not necessary, however, when the skins have been first dyed with direct or acid colors, and a small quantity of basic color only is used. A color lake is formed between the basic and direct or acid colors. All of the basic colors are applicable to leather treated as before stated, and those fastest to light are the Phosphines, Thioflavine, Bismarck Brown, Safranine, Methylene Blue and fast Indigo Blue. The colors which have the greatest penetrating powers among this class are Auramine, Chrysoidine, Fuchsine, Methyl Violet and mulachite Green. These colors also are made much faster to fat-liquoring and light when after-treated with bichromate of potash, tartar emetic, bluestone or potassium titanium oxalate. These after-treatments, however, sadden the shade materially, and this fact should be borne in mind when using these compounds. It is the opinion of the writer that a more intimate knowledge of the application of these various groups of dyestuffs and their combinations can be obtained by giving working formulae. With this in mind I will give formulae which have been worked out in practice on various shades.

On most light shades on chrome-tanned leather with the exception of light blues, pinks, lavenders and greens, the shades are mainly produced with combinations of the dyewoods and various "strikers," as chrome, bluestone, titanium oxalate and copperas, and just enough dyestuff to give the skins the proper amount of brilliancy. The dyewoods alone leave a dull appearance on the leather. For the other light shades above mentioned acid colors are used entirely, and it would be almost impossible to obtain level shades with these colors alone. A typical example is as follows:

Light Green on Chrome-Tanned Ooze Leather.

(Per 100 lbs. of skin, wet weight.)

Two oz. Napthol Green B, running the skins half an hour. Allow to drain, and then treat the skins in successive baths of lead acetate and sulphuric acid, moving them from one bath to the other without rinsing. By this treatment a fine, white precipitate of lead sulphate is evenly distributed throughout the fibres of the skin, lightening the shade. This process is continued until the desired shade is obtained, after which the skins are fat-liquored and dried in the customary manner.

For light sand shades and the so-called putty shades an entirely different procedure is followed. Here the dyewoods are utilized to produce the largest part of the coloring.

(Per 100 lbs. chrome tanned calfskins, wet weight.)

5 lbs. sumac extract; run 45 minutes at 130° F., drain and strike with—
2 lbs. ferrous sulphate, run 15 minutes, and wash thoroughly.
1 lb. quebracho extract.
8 oz. fustic extract, run 30 minutes at 130° F., drain, and dye with—
1½ oz. Phosphine.
½ oz. Bismarck Brown, run 30 minutes at 130° F., drain and finish in the customary manner.

Another of the fashionable shades is a light grey, which may be produced successfully as follows:

(Per 100 lbs. chrome calf, wet weight.)

5 lbs. sumac extract, run 30 minutes at 130° F., add
2 lbs. 8 oz. ferrous sulphate, run 30 minutes, rinse well and dye with—
2½ oz. Phosphine, run 30 minutes, drain and fat-liquor with—
2½ oz. Nigrosine, jet shade.
11 lbs. egg yolk.
3 lbs. acid fat liquor. Run 30 minutes, drain, and tack out to dry.

Leather Finishes.

Glaze Finishes are prepared by soaking albumen in water; egg albumen for colors and blood albumen for

black, and then adding a small amount of gelatine to the mixture, and bringing the solution up to the right consistency with water. Enough dyestuff is added to the finish to slightly color it except for black, and in this case the finish is rather strongly colored. It is brushed on the leather, and when dry is glazed on the machine.

The following list of colors will be found suitable:

For Yellow: Azo Yellow.
For Red: Croceine Scarlet.
Fast-Red A.
Browns: Resorcine Brown.
For Blue: Napthol Blue.
For Green: Acid Green.
For Black: Nigrosine W.S.

Protective Finishes.—Under this head come finishes which are to protect the leather from outside influences, such as rubbing-off in the case of upholstery and saddle leather. For this the solutions should be colored only enough to prevent a white cast on the leather due to the finish.

Collodium Varnish.—This is a solution of nitrocellulose in amyl acetate, colored with suitable combinations of the oil-soluble colors which are dissolved in the varnish by agitating. Very often castor oil is added to this finish to give elasticity to the finish. As many coats as necessary are applied.

Shellac Solution in Alcohol.—This solution is prepared by dissolving the proper amount of shellac in alcohol and coloring with any of the basic colors, depending upon the shade of the leather to be finished. Part of the alcohol may be replaced by turpentine. In place of the alcohol used as a solvent for the shellac, borax and ammonia may also be used, in which case the basic colors are first dissolved in water before being added to the finish.

GLAUBERS' SALTS DEPOSIT IN SASKATCHEWAN.

Deposits from which Glaubers' Salts (sodium sulphate) may be obtained are being worked near Saskatoon, Sask. It is estimated that the deposit contains 9,000,000 tons. The deposit is in the vicinity of Muskiki Lake, near Kaskakee Springs, on the Prince Albert branch of the Grand Trunk Pacific Railway. It is composed of a double salt, composed of sodium and magnesium, and is commonly known as crude Glaubers' Salts, or salt cake sulphate. An evaporating plant is being built at Kaskakee Springs, and a railway siding built. At present the crude natural is being shipped to Kitchener, Ont., to the plant of the Salts and Potash Company for refinement, who are also operators of the deposit. Similar deposits in a lake at Oban, Sask., will be developed by a company recently organized under the name of the White Shore Chemical Company, L.H. It is stated that the deposit at Oban has an area of eight square miles with a maximum thickness of eight inches.

THE STEEL AND SHIPBUILDING INDUSTRIES.

The work of erecting the new plate mill and the coke ovens at the plant of the Dominion Iron and Steel Company at Sydney, N.S., is progressing, the plate mill being almost completed. President Workman stated recently that plans are being matured to include a most comprehensive scheme which would mean the further expenditure of large sums at the Sydney plant. The plate mill would be the natural step towards creating Canadian merchant fleets, affirmed Mr. Workman, who was sure that Nova Scotia would regain her one-time prominence as a shipbuilding community. Nearly one million and a half dollars had been spent by the company in Newfoundland in developing the mines and quarries.

EXPORTS OF CHEMICALS FROM CANADA.

During the month of August, 1919, Canada exported 5,830 cwt. of acetate of lime to the United Kingdom, 7,203 cwt. to the United States, and for the five months ending August, 1919, exported a total of 54,210 cwt. of acetate of lime to all countries, valued at $156,231. It is interesting to note that for the five months ending August, 1919, Canada exported 2,873 cwt. of glycerine to the United States, valued at $34,621, a trade that had been stopped during the war due to the need of glycerine here for explosives. The shipments of calcium carbide to the United Kingdom for the five months ending August, 1919, totalled 137,978 cwt., valued at $571,651, as compared with 87,335 cwt. for the same period in 1918 valued at $298,640. For the same period in 1919 Canada also exported 129,413 gallons of wood alcohol to the United Kingdom, valued at $241,922. Of petroleum oil (coal and kerosine oils) refined, Canada exported for the five months ending August, 1919, 503,117 gallons to the United Kingdom valued at $40,639, and to the United States 486,040 gallons valued at $42,105.

PITCHBLENDE DISCOVERY IN ONTARIO.

Mr. Cyril W. Knight, of the Bureau of Mines, Ontario Government, recently made an investigation into the reported discovery of pitchblende (the ore in which radium is found) in Butt Township, east of the Georgian Bay. One or two ounces of pitchblende were found by Mr. Knight. The mineral was examined by Mr. M. K. McNeill, provincial assayer of Ontario, who identified it as pitchblende, and found it strongly radio-active. The deposit is 22 miles northeastward from Kearney, a town on the Grand Trunk Railway.

The pitchblende occurs sparingly in a coarse, granite pegmatite dike. The dike has been worked by an open cut about 40 feet long and seven or eight feet deep. The dike appears to be three or four feet wide, and at least 40 feet long, and consists of white feldspar, red feldspar, white quartz, smoky quartz, white and black mica, some tourmaline, pitchblende and other minerals in small quantity. The pitchblende appears, states Mr. Knight, to be associated with the red feldspar, resembling in this respect the occurrence of euxenite, a radium-bearing mineral in Lanark County, Ontario, described in the 26th annual report of the Ontario Bureau of Mines, 1917. The euxenite in Lanark also occurs in a coarse granite pegmatite dike.

The pitchblende was discovered by Mr. Wm. Elliott, who has been mining the deposit for mica during the past three years. He forwarded a sample of his discovery to Ledoux & Company, of New York, who sent the following report, sample No. 1 being the mineral itself, and sample No. 2 the feldspar in which it occurs:

No. 1—Uranium .....63.60 per cent.
Equivalent to uranium oxide (U_3O_8) .74.98 per cent.
No. 2—Uranium ..... 0.35 per cent.
Equivalent to uranium oxide (U_3O_8) 0.42 per cent.

The report also stated that the radio activity of sample No. 1 was very high, and contained radium in the proportion of about 190 milligrams per ton, calculated at the usual uranium ratio.

Radium-bearing material has now been discovered twice in Ontario, but neither one of the two (Butt township or Lanark) are eligible for the $25,000 award made by the Ontario Legislature in 1914 to the first discovery of ores or substances containing radium in sufficient quantities for commercial extraction, as neither one, so far as shown, has radium present in commercial quantity.

BOOK REVIEWS

"Explosives."

By E. deBarry Barnett—241 pages, 33 figures. Published by Bailliere, Tindall- and Cox, London, England. Price, 12s. 6d. net.

This volume is one of the first of a series of handbooks being edited by Samuel Rideal, D.Sc., F.I.C.

The purpose of the series, as outlined in the editor's preface, is to give a general survey of the industry showing how chemical principles have been applied and have affected manufacturing, and dealing with the subject from a chemical rather than an engineering standpoint.

The book is divided into nine sections, dealing respectively with gunpowder, explosive compounds, smokeless propellants, blasting explosives, safety coal mine explosives, percussion fuses, etc., matches, pyrotechny, etc., explosive properties and tests, sensitiveness and stability. Not the least valuable are the author's concluding remarks and a good index.

No attempt has been made by the author to deal exhaustively with this subject, but a general outline of the manufacturing processes is given, and, at the end of each section, a guide to current literature enables those interested to obtain further information.

As might be expected, the author shows a much more intimate knowledge of British manufacturing practice than of American. For example, in the manufacture of cordite, no reference is made to the American practice of dehydration of gun cotton with alcohol, thus doing away with the dangerous stove drying, or of the addition of a solution of nitroglycerine and acetone direct to the mixer to do away with the paste incorporation.

Still more surprising is the failure of the author in the brief paragraph on acetone to refer to the Canadian process of synthetic production of acetone from acetylene, although he mentions the production of acetic acid by the same process as an experiment.

The author has successfully followed the intention of the editors as outlined in the preface, and this volume will find a place in the library of all those interested in the general chemical technology of explosives and allied compounds, and will be particularly valuable to the technical man interested in the industries concerned who is not a chemist.

The book will also be valued by those familiar with the subject from a business point of view and who wish to know something of the practical side.

As a good general guide to the industries described, nothing better has come to our notice.—J. R. Donald.

SHIPPING GOLD TO THE ORIENT.

Large shipments of gold to the Orient have been made from San Francisco recently. The total aggregated $8,500,000, of which $6,000,000 was for Japan and the remainder for China.

COBALT OXIDE TO UNITED STATES.

During 1917 Canada exported 276,406 pounds of Cobalt oxide, valued at $275,821, to the United States, and in 1918 the shipments were valued at $291,699.

PERSONALS

Professor H. H. Thomson has been appointed to the chair of metallurgy in the University of British Columbia. Prof. Thomson is a graduate of McGill University.

Mr. George A. Gillies, M.Sc., has been appointed assistant professor of mining at the University of British Columbia.

Major L. W. Gill, after three years' service in France in command of the 46th (Queen's) Battery, is again in charge of the Department of Electrical Engineering at Queen's University, Kingston, Ont. After the signing of the armistice he was appointed director of the Khaki University in England.

Mr. Ross E. Gilmore, of the Fuel Testing Plant of the Department of Mines, Ottawa, has been appointed chief chemist for the Standard Chemical Company, Toronto.

Mr. L. A. Brown, who has been chemist for some time at the Dominion Experimental Farm, Ottawa, has accepted a position as a demonstrator in physiological chemistry at McGill University.

Mr. W. F. Geddes, chemist with the Kellogg Toasted Corn Flake Company, London, Ont., has been appointed associate professor of chemistry at the Manitoba Agricultural College, Winnipeg, Man.

REPORTS AND CATALOGUES RECEIVED.

General Catalogue No. 18, Gifford-Wood Company.—A 480-page catalogue gotten out by this well-known company of Hudson, N.Y., strongly bound in green cloth and carrying several hundred illustrations. The book is divided into eight sections dealing with: Chains and Sprockets, Gears, Pulleys and Belting, Shafting, Bearings and Take-ups, Clutches and Couplings, Miscellaneous, Machines, and Installations.

Bristol's Recording Instruments, Catalogue.—This is one of the very best descriptive catalogues that we have seen in some time. It is bound in loose-leaf style between strong red board covers. It contains descriptions, illustrated profusely with cuts of both the exterior and interior of the many hundreds of different kinds of guages made by this firm at their plant at Waterbury, Connecticut. Included in the catalogue are recording guages for steam boiler pressure, exhaust pressure, steam pressure for dry kilns, vulcanizers, pulp digestors, brick dryers, air compressors, pressure and vacuum in ammonia lines, vacuum guages for condensers, gauges for water, gas and by-product coke-oven gas, air pressure on filter presses, etc.

A CORRECTION.

On page 338 of the October issue, in quoting statements made by Mr. H. W. Matheson at the proceedings of the Chemistry Committee of the Honorary Advisory Research Council, the word "hardly" should have been "readily," and the sentence corrected should therefore be: "I can readily second Dr. McIntosh's statement." It is obvious that all members of the committee should agree on the necessity of a thorough scientific training for students preparing to undertake research work.—The Editor.

MOLYBDENUM IN NORWAY.

Norway's molybdenum properties have been examined recently, with satisfactory results. As a result of the investigation it was decided to form a company, capitalized at 500,000 kroner, to develop properties on which this mineral occurs.

Chemical Society News

The first meeting of the Toronto Branch of the Society of Chemical Industry was held on October 24th. Prof. E. G. R. Ardagh is again Chairman of the Branch, with Mr. L. T. Acton as secretary. It was announced that monthly meetings would be held, at which prominent men would give addresses of a general nature, on subjects of interest to those following the advances of research and industrial developments within the country.

The idea of having a number of small groups within the branch will be carried out this year again. Arrangements have been made for Rubber, Packing House, Pharmaceutical, Oil, Paint and Varnish groups, at which technical papers may be presented or discussions followed, involving very special knowledge and interest.

At the present time there is a proposal before the branches of the Society of Chemical Industry, which will, if carried out, result in the establishing of three sections where only one exists at present. Montreal Ottawa and Toronto would then be directly connected with the council of the society in London. In this way it is hoped that most of the cumbersome administrative machinery and clerical work can be done away with.

While this change is in progress, it would seem well to have an effort made to unite all similar chemical organizations in the Dominion under one head. It was thought that if the Canadian section took the above action, the British Columbia section would be willing to co-operate through an overhead all-Canadian council, consisting of the officers of the various sections. Feeling was expressed that it would be very advisable to take this step in the Canadian section, for the reason that the chemists now organized under the Maritime Chemical Association and the Manitoba Chemical Society, or at points where organization might be possible, would then be able to establish a section of the Society of Chemical Industry, which would be connected only with the London council, and through an all-Canadian committee, representing the whole Dominion for purposes which might be deemed necessary.

There is a feeling that it is very essential that some society should unite the industrial chemists of the Dominion under one head.

The speaker of the evening was Mr. J. B. Challes, of the Dominion Water Power Branch, Ottawa, who gave a most interesting address on the water power situation in Canada. Mr. Challes' remarks were quite informal, being, as he described them, more of a "talk," but were none the less followed with the closest of attention by all present.

It was time for the chemist and engineer to link up together, especially in regard to the water-power question, declared Mr. Challes. He considered it quite a remarkable feat that the Electrical Engineers were meeting in the same building on the same evening to discuss the very same problem that the industrial chemists were discussing. In his opening remarks the speaker briefly outlined the water power situation in Europe. Prior to the war, Germany had conrolled the power developments in every country except the United Kingdom. In Italy and Switzerland, Germany had designed and constructed, through her powerful corporation, the Aeg, all the water-power plants. That was the one principal reason for Italy not entering the war sooner than she did, as her whole industries would have been paralyzed had she acted without first freeing her power plants from German control. Even to-day, Germans control the power situation in Switzerland, Austria, Norway and Sweden. It was encouraging to know that the British Government was to-day considering a bill that would evolve a master power development scheme for England, Scotland and Ireland. Turning his attention to Canada, Mr. Challes declared that the water power problem had come to the place where it was one for research. Unless the chemists could find some greater use for the power developed, and that which could be developed, power development would be greatly handicapped.

Power and fuel were inseparably connected, so much so that one refers now to the power-fuel problem. As regards fuel, in Canada there were five sources—wood, oil, natural gas, peat and coal. Only a few years ago there was $60,000,000 expended by Canadians on wood for fuel purposes. The better use and development of oil was a chemical problem. Mr. Challes was confident that good results could be obtained were more time and money expended on the development of the oil shales in New Brunswick; also better use might be made of natural gas resources of Ontario. While peat might never be used at a natural fuel, as it is in Ireland, yet it should not be entirely neglected. Regarding coal, it was significant that the Honorary Advisory Council of Research had been successful in having $400,000 expended on a plant at Estevan, Sask., for the briquetting of Alberta coal. Nova Scotia coal could, by the low carbonization process, be made to compete with United States anthracite coal, and valuable by-products would be saved by that process.

There were over 300,000 h.p. exported from Canada to the United States annually. The whole of Ontario represented the chief section of what was known as the "Acute fuel area" of Canada, that is the section where the country was dependent at present on the United States for coal, but where, also, the greatest water power development occurred. The eastern provinces, including Ontario, controlled the water-power development of their rivers by their own provincial governments, but the Federal Government controlled the navigation of these rivers. In the three new western provinces—Alberta, Saskatchewan and Manitoba—the Federal Government controlled both water power and navigation, and also in the Railway Belt (the strip of 40 miles on the C.P.R.) through British Columbia. In Nova Scotia, water-power development was being encouraged, while in Manitoba the possibilities of the Winnipeg River were remarkable. The great power developments at Niagara Falls by the Ontario Hydro-Electric Commission, and at Shawinigan Falls, Que., by the Shawinigan Water and Power Company, were referred to by Mr. Challes as outstanding examples of what Canada had done already in the development of her water-power resources.

IRON ORES AND HYDRO-ELECTRIC POWER.

At a meeting of the Hastings County Branch of the Canadian Mining Institute, Mr. J. Walter Evans, Belleville, Ont., dealt with the application of hydro-electric power to mineral development. The development of the electric furnace, Mr. Evans pointed out, had demonstrated that magnetic ores high in sulphur and in titanium could be smelted successfully in the electric furnace. With electric power at $10 per h.p., and charcoal at $14 per ton, pig iron could be made at the rate of 100 tons per day at a cost of $25 per ton, and there was available in Hastings County over 20,000,000 tons of iron ore, including large bodies of sulphide ores suitable for the manufacture of sulphuric acid.

DEVELOPING GOLD IN ABITIBI.

The British Minerals Corporation, Limited, Montreal, have recently purchased the gold deposits discovered in the Harricana River district, in Northwestern Quebec, first discovered by two Polish prospectors, the Siscoe brothers. The Siscoes received $850,000 for their property from the British Corporation who are developing the deposits. Dr. J. Austen Bancroft, Professor of Geology, McGill University, Montreal, in May last, made an examination of these deposits and in his report states in regard to two of the veins that stripping or trenching should be done to determine the true length and dimensions of the veins with the chief hope of the possibility of discovering gold-bearing veins of larger dimensions. Two other engineers, John W. Bell, M.Sc., and John A. Dresser, M.E., place a good prospective value on one zone of the deposit, in particular stating that some very rich ore occurs there. The Financial Times, of Montreal, recently stated that a new era in respect to the gold industry of the Province of Quebec is coming, and that the results from the development work in the Harricana River district augurs well for the future.

THE WORLD SHORTAGE OF PHOSPHATE.

Since the outbreak of the war in August, 1914, the world's production of phosphate rock has not been normal. Production in the United States in 1913 was 3,161,145 metric tons, but in 1917 this amount had fallen to 2,625,000 tons, and comparing the production of all the seventeen countries where phosphate is produced, for 1913 and 1917 we find that there was a decrease of about 54 per cent. Production in the United States declined each year following the outbreak of the war until 1917, when there was a marked increase. Production in Tunis (the second largest producer in the world) dropped in 1914 and 1915, increased slightly in 1916, to be followed by a sharp decline in 1917. Taking the year 1913 as a basis, and assuming that production was not greater in 1918 than in 1917, which seems to be conservative, the total amount of phosphate necessary to make up the shortage which has been occurring in all countries since 1913 amounts to about fifteen million tons. It is important to remember also, that while basic slag as a source of phosphate must be considered, yet the basic slag industry, in spite of a largely increased steel business in Great Britain due to the war, did not increase rapidly enough to offset the decrease in importation of natural phosphate. The United States is, of course, the largest producer of natural phosphate, and it is calculated that the United States export business in phosphate during the war was 5,000,000 tons less than it would have been in normal years. The United States Government's special commission, sent to Europe in 1918 to investigate agricultural conditions, report a big demand for fertilizer in Europe, and the United States Shipping Board is now co-operating with the producers of phosphate in the United States to develop the export business.

In Canada the production of natural phosphate has fallen off in recent years, due largely to the development of the United States deposits. There are certainly important deposits of phosphate in Eastern Ontario and Western and Southern Quebec. Only a small amount is now being taken from the grounds. This is manufactured at Buckingham, Quebec, partly into phosphorous by the Electric Reduction Company, and partly into fertilizer by the Capelton Fertilizer Company, also at Buckingham. In fertilizing manufacturing, phosphate rock (natural phosphate) is pounded and then treated with sulphuric acid, giving acid phosphate. Phosphorous is manufactured from phosphate rock by a process of reduction in an electric furnace. It can also be obtained from the acid phosphate.

PROFESSOR COLEMAN IS DEAN.

Professor A. P. Coleman, head of the Department of Geology at the University of Toronto, has been appointed to succeed Prof. Alfred Baker as Dean of the Faculty of Arts. Dean Coleman is widely known as a geologist, and is well versed in literature, is an amateur painter of good standing, some of his paintings having been hung in the gallery of the Ontario Society of Artists. Deal Coleman has also a great appreciation of music, and it is seldom, indeed, that one finds the scientific and literary abilities so well blended in one individual as they are in Dr. Coleman. He graduated from Victoria College in 1876, made a Ph.D. from Breslau University, Germany, in 1881, and in 1882 was appointed as Professor of Geology at Victoria College, Toronto. In 1891 he was appointed to the same chair at the School of Science, University of Toronto, and two years later became geologist to the Ontario Bureau of Mines. Dr. Coleman surveyed and mapped out the Sudbury nickel areas for the Ontario Bureau of Mines, and his knowledge of the rocks of Northern Ontario is said to surpass that of any other individual.

TO REGULATE SALE OF BORAX-POTASH FOR FERTILIZER.

The Department of Agriculture of the United States has investigated the damage to crops attributed to the use of fertilizer containing high borax-potash, and has traced in important instances this potash to the product of Searles Lake. In order to permit the safe use of this product in future, the department has, under authority of the Control Act of August 10, 1917, decided to place such restrictions on the use of potash salts containing borax as will guarantee the use of an application of not more than two pounds of anhydrous borax per acre. In order to effect this measure of safety, the department has issued instructions to the producers of potash salts at Searles Lake and to all brokers, fertilizer manufacturers and mixers not to sell potash salts direct to farmers as straight goods when they contain more than five-tenths of one per cent. of borax, and not to sell mixed fertilizers containing more than two pounds of borax per ton unless the amount of borax contained is plainly shown upon the container.

This regulation is issued to insure that in no case shall a fertilizer application be made by farmers without their knowledge, which would add more than two pounds of borax to the acre. The department feels that such restrictions will make the use of potash salts from Searles Lake as safe under all conditions of agriculture as is the use of nitrate of soda, acid phosphate, and other fertilizer constituents.

The International Abrasive Corporation is making application for listing on the Boston Stock Exchange. This consolidation is of interest to Canadians, as it is comprised of the Superior Corundum Wheel Company, Dominion Abrasive Wheel Company, Harrison Supply Company, and National Abrasive Company, with plants at Waltham, Mass., Amesbury, Mass., Niagara Falls, Ont., and Mimico, Ont. Three of these companies are successfully established. The National Abrasive Company is a new producer.

INDUSTRIAL SECTION

Construction, Manufacturing and Market News

British Columbia.

Trail.—Shipments to the Smelter at Trail, from January to July (inclusive), of this year, totalled 210,131 tons. Twenty mines are now shipping to this smelter, of which 16 are in British Columbia. The largest producers are the mines of the Consolidated Mining and Smelting Company.

Vancouver.—Reports received state that the tobacco acreage in B.C. this season is the largest in many years. Good progress was made in the Kelowna and New Westminster districts. Tobacco grows quickly in B.C., being set out in June and harvested about middle of August.

The Hyatt Steel Products Company has been reorganized and the Industrial Island plant will be reopened and run under the name of the Atlas Steel Products Company.

The Canadian Waterwheel Co. have removed into a new factory on Industrial Island, and will manufacture waterwheels, both impulse and turbine, and governors.

The Vancouver Milling Company is opening branch offices in Harkow and Shanghai, Japan, and proposes to extend its foreign trade, especially in the handling of oils from the Orient.

The Sumner Brass Foundry has been moved to larger premises at 610 Bidwell Street, Vancouver. This is the largest brass foundry in British Columbia.

A Liverpool, England, company will establish a wire rope factory on Industrial Island.

Western Canada Tire & Rubber Co., Ltd., have moved to larger premises at 610 Lorne West, Vancouver, and are installing additional machinery.

The Canada Western Woollen Mills has been incorporated with a capital stock of $200,000. The Maple Leaf Iron Works are building a new machine shop at 425 Alexander Street.

Lynch Creek.—Three new decrepitating furnaces and rotary kilns are being installed at the concentrator of the Rock Candy mine of the Consolidated Mining and Smelting Company. It is expected that the big fluorite property of the North Fork will shortly be commencing heavy shipments.

Gabriola Island.—The Gabriola Shale Products Co. have reopened their plant on Gabriola Island, Straits of Georgia, and have made many alterations and improvements to the plant, in which brick of the best grades will be made.

Nanaimo.—The Nanoose Collieries Company, Nanaimo, has sold its interests to the Nanoose Wellington Coal Company, the transfer comprising approximately 1,200 acres, including the submarine area. $100,000 will be spent in the development of the property with the object of obtaining a daily output of 500 tons. Mr. Lewis Williams, of Seattle, is president of the new owning company, and has associated with him other Washington and St. Paul capitalists.

Copper Mountain.—The West Kootenay Light & Power Company is having a $20,000 sub-station built at Copper Mountain.

Orchard City.—The Orchard City Evaporator have purchased the aerated water manufacturing and bottling plant of Western Canners, Limited.

Princeton.—It is expected that work will soon commence on the erection of a mill and concentrating plant for the Canadian Copper Corporation at Allenby at a cost of about $200,000.

Manitoba.

Winnipeg.—The Burgess Battery, Ltd., nave opened a factory at 701 Wellington Avenue for the manufacture of dry cell batteries.

A charter has been granted by the Manitoba Government to the Red River Paper Mills, Ltd., who will probably construct a new mill soon.

New Brunswick.

St. John.—The Corona Candy Co. is planning to enlarge its plant.

Sydney.—The Nova Scotia Steel and Coal Co. will proceed shortly with the erection of a by-product plant, costing over $2,000,000. The present plant will have to be enlarged to make room for the new ovens, and an additional blast furnace erected.

Ontario.

Brantford.—The Robbins and Meyers Co., of Springfield, Mass, has purchased ten acres here for the erection of a plant to employ 350 hands. Small electric motors and fans will be manufactured.

The Brantford Oven and Rack Co. will double the capacity of their plant.

Dunnville.—After being practically closed down during the war, the Canadian Engines, Ltd., manufacturers of gas engines, have resumed operations.

Ford City.—The new distributing plant of Imperial Oil, Ltd., is nearly completed. The greater part of Western Ontario will be supplied from this plant.

Belleville.—The Burrell Rock Drill factory plant has been secured by the Elliott Wood Working Company, of Toronto, who will commence operations immediately.

Hamilton.—The Dominion Canners, Limited, have purchased a site of six acres in the east end, and the Company intends to erect a plant there to cost $1,000,000. One of the features of the new plant will be a large brass preserving kettle, lined with aluminum, costing $25,000, for which the contract has already been let.

The Smart Turner Machine Co. is erecting a new building to cost $15,000.

An addition costing $27,000 will be built to the factory of the Frost Steel and Wire Co., Ltd.

The Burlington Steel Co. will erect a $12,000 addition to their plant.

The Dominion Sheet Metal Co., Ltd., will build a $23,000 addition to their factory.

Kitchener.—The Lavy Tanning Co. will erect two warehouses at a cost of $24,000.

Kipewa, Temiskaming.—Construction of the Riordon Paper Company mill at Kipewa, is almost completed. Early in 1920 it is expected the new mill will be producing 30,000

tons of bleached sulphite annually. The Riordon Company invested approximately $4,000,000 in the Kipewa mill.

New Liskeard.—The M. J. O'Brien Company, Ltd., capitalized at $20,000,000, controllers of the O'Brien mine at Cobalt and other large interests, is involved in the construction of a new large pulp and paper mill at the north end of Lake Temiskaming, erection of which is expected will commence next year. Power will be secured from the Quinze River, and upwards of 100,000 h.p. can be developed.

Niagara Falls.—The Niagara Wire Weaving Co. will erect a $60,000 factory here.

Oshawa.—The Ibex Tire and Rubber Co. of Canada, Ltd., may establish a plant here.

Five new buildings are being added to the plant of the Pedlar People, Ltd.

Petolea.—The Stevenson boiler works have been purchased by Frank A. Halstead, of Port Huron, Mich., who will remodel it for the manufacture of soaps and greases, employing from 25 to 40 hands.

Toronto.—The Toronto Wool Scourings Co., Ltd., have removed their plant from Lake Street to the former Reinhardt Brewery, on Dundas Street East, affording greatly increased production, the capacity now being 15,000 lbs. of wool per day.

A ten-storey brick and concrete factory and warehouse to cost $358,000, will be erected by the Northern Aluminum Co., on Sterling Road.

The Sunbeam Chemical Co. of Canada, Ltd., a branch of the Sunbeam Chemical Co. of Chicago, Ill., are opening a plant at the corner of Jarvis and Lombard Streets for the manufacture of dyes, dye products and disinfectants, and will employ about 40 hands.

Production has commenced of welded steel tanks at the plant of the Canadian John Wood Manufacturing Co., Ltd., on Hillington Avenue, recently purchased.

An addition to the factory of the Quaker Candy Co. will be built.

Trenton.—The cold storage building here will be remodelled into a factory in the manufacture of paints. A Montreal paint company is interested.

Windsor.—The Helbring-Wright Chemical Co., of Detroit, Mich., is planning the erection of a plant here, as is the Peninsular Machine Co., of Detroit.

Prince Edward Island.

Charlottetown.—A new machine shop will be erected by Bruce, Stewart & Co., Ltd.

Quebec.

Caluet.—A plant costing $100,000 will be erected by the North American Magnesite Co., Ltd.

Montreal.—The Anglo-Canadian Wire Works, Ltd., will erect a factory to cost, it is estimated, $50,000.

Montreal.—The Dominion Bridge Company has closed a contract with the Laurentide Paper Company for the construction of an entire new set of paper making machines. The Dominion Bridge Company embarked in this new business this year and will carry out the contract for the Laurentide Company at their Lachine works.

The Montreal Locomotive Works are erecting several additional buildings at their plant at Longue Point.

Quebec City.—A contract has been let for a $20,000 factory for the Imperial Tobacco Co., of Canada.

Sherbrooke.—An addition to their plant is being considered by the Connecticut Cotton Co.

Three Rivers.—The Lava Cement, Clay and Silicate Products Co. will erect a plant here.

CONSTRUCTION AT OJIBWAY PROGRESSES.

Work on the construction of the plant of the Canadian subsidiary of the United States Steel Corporation at Ojibway, Ontario, is proceeding at a fair pace. The preliminary work is now well advanced, and one of the two large blast furnaces that are being finished in connection with the present program is already well on the way towards completion. It is unlikely that an equally favorable opportunity will be afforded for winter work outdoors as was presented last year, but an effort will be made to conduct operations as fully as possible during the coming months. The experience of the Canadian Steel Corporation goes far to offset the theory that there is a surplus of labor. Difficulty has been experienced in getting and keeping men on the job. The Corporation leaves no room for doubt as to its intention to prosecute construction work actively as soon as this can be done. Labor conditions have not been favorable for operations on a major scale. Much more progress is being made than was the case during the war. Steel is being fabricated in the American mills of the Corporation for plant units, and the site will be considerably transformed during the next eight months. A suction dredge is now at work removing earth in the channel between the ore and coal docks. A good part of the entire length of 2,400 feet has already been traversed.

EXPORT OF CANADIAN CONFECTIONERY INCREASES.

It is interesting to note that the export of Canadian confectionery is increasing at a rapid scale. Recently Canadian manufacturers of confectionery sent agents to England, the West Indies, and South America, and some good-sized orders have come in from these markets. During the war the British firms lost their export business, and they are now busy regaining it, and as a consequence their own home trade is being somewhat neglected, and Canadian concerns are going after it, and find it impossible to supply all the demand of the British home market.

COMPANY NOTES.

Supplementary letters patent have been issued under the Seal of the Secretary of State of Canada bearing the date the 18th day of September, 1919, increasing the capital stock of McArthur-Irwin, Limited, the well-known Montreal company (chemicals and oils), from $360,000 to the sum of $1,000,000. The increase consists of 6,400 shares of $100 each.

The National Electro-Products Company, Montreal, have received letters patent increasing their capital stock from one million to two million dollars.

SCARCITY OF MEDICINAL PLANTS.

The present shortage of camphor, licorice root, sarsaparilla, attar of rose, digitalis, gentian, ginseng, golden seal and cascara sagrada, for the drug trade is due to lack of labor to harvest the plants. This shortage was discussed at the recent meeting of the American Pharmaceutical Association, and it was brought out that the labor shortage was due to the fact that the war had taken many of the collectors of these medicinal plants, and it has been found impossible to fill their places, even with women or children, for these are unwilling to return from their work on the farm and in industries where they were placed during the war to allow the men to go on war service.

NEW YORK LETTER

Special Correspondence to The Canadian Chemical Journal by F. M. Turner, Jr.

New York, Oct. 28th, 1919.

ON September 11th, 1919, Dr. Edward G. Love died in Roosevelt Hospital, New York, following an operation. Dr. Love was 69 years old. He was Treasurer of the American Chemical Society and one of the best known of American chemists. Dr. Love, as a boy, served in the Civil War as a drummer-boy, afterwards going to Hamilton College, from which he was graduated in 1872. He later took a course at the School of Mines at Columbia. He studied chemistry under Dr. Chandler and took his Ph.D. in 1877. He opened an analytical laboratory in New York and became the first Gas Examiner for New York City. He was also analyst for the City and State Boards of Health. In 1913 he became Chief Chemist of the Consolidated Gas Company. He rendered invaluable service during the late war in enabling this immense plant to separate its tolueue for use in explosives.

Dr. Love was chiefly responsible for the formation of the fine library of the Chemists' Club, of New York. As Treasurer of the American Chemical Society, Dr. Love handled an exceedingly large volume of tedious work in the most painstaking manner.

As a chemist, Dr. Love had a fine sense of the responsibility of his profession and took his work seriously. Several times he served in official capacities in the Chemists' Club. He belonged to numerous learned and patriotic organizations and several clubs, as well as to all the various chemical bodies.

Much as he is missed as a chemist, Dr. Love is more missed as a man. His genial personality was one of the institutions of the Chemists' Club. Whenever Dr. Love was in the house he was the centre of a jovial circle. Age seemed to have no effect on his energy and enthusiasm. To the last, Dr. Love was, in spirit, one of the youngest members of the chemical profession in New York. He numbered amongst his friends practically all the prominent chemists of the United States and Canada, as well as hosts from abroad. His place will indeed be difficult to fill.

Industrial Alcohol Discussed.

Friday, Oct. 10th.—A meeting of the New York Section of the American Chemical Society was held in Rumford Hall, the subject being Industrial Alcohol. Mr. B. R. Tunison, of the U. S. Industrial Alcohol Co., explained the various sources of non-potable alcohol and the uses of this most important substance. Mr. Tunison stated that in proportion as gasoline became dearer, alcohol would advance in use as a motor fuel. Since over 50,000,000 gallons a year could be made from molasses alone in the United States, this is a plentiful permanent supply of fuel. The second paper, by Dr. F. W. Kressman, dealt with the manufacture of ethly alcohol from wood-waste, giving details about the various proposed processes. The third paper, by Dr. G. F. Richmond, dealt with the use of the higher alcohols in synthetic perfumes and flavorings. Prof. Rolph H. McKee spoke on the manufacture of alcohol from the sulfite waste liquor of the pulp industry, and Dr. Z. H. Cretcher spoke on the use of alcohol in the dyestuff industry.

Interesting Items and Personals.

During the nine months ending Sept. 30th, the General Chemical Co. earned $15.20 a share. The earnings for the corresponding period in 1918 were $23.98 per share.

Corn Products Refining Co. plants at Argo and Pekin, Ill., and Edgewater, N.J., are to be improved, the improvements costing $7,500,000, and bringing the refining capacity up to about 150,000 bushels per day. The funds are derived from the sale of some of the company's subsidiaries necessitated by anti-trust proceedings some little time ago.

The plant of Maas and Waldstein, North Newark, N.J., seriously damaged by fire some months ago, is being rebuilt.

T. J. Parker, a prominent chemical merchant of New York, and one of the oldest members of the American Chemical Society, and a member of the Chemists' Club, died this month. Pathetic interest is added to Mr. Parker's death by the fact that he was one of the most intimate friends of the late Dr. E. G. Love.

Herman Madoeny, President of the Madoeny Chemical Works at Basle, Switzerland, is in New York with the Swiss Trade Commission. Mr. Madoery is visiting the principal chemical centres of America.

Chas. R. Delaney, of the J. S. Young Co., Hanover, Pa., one of the leading manufacturers of natural dyestuffs in this country, is severing his connection with that concern and retiring from commercial life.

Herman A. Metz is bringing suit against the Alien Property Custodian to compel the return of stock in certain concerns seized by the A. P. C., as being held by German interests, which is desired by Mr. Metz.

A campaign is in force to raise $10,000,000 endowment for Massachusetts Institute of Technology. An unknown benefactor has promised $7,000,000 if $4,000,000 additional can be secured before Jan. 1st, 192. The endowment is necessary unless fees to students are to be raised.

B. T. Bush, President of Ontoine Chiris Co., essential oils, etc., has sailed for Europe on a business trip of some weeks' duration.

Mr. W. G. Adam, manager of the Gas, Light and Coke Co., Tar and Ammonia Works, Beckton, England, has been spending some time in New York and at the Chemical Show in Chicago, and has just returned to England.

Mr. David A. Keys, a graduate of the University of Toronto, who has been doing very valuable work at the Admiralty Experiment Station of Great Britain, is now at Harvard, where he has been granted a fellowship and is carrying out an investigation on variations in the specific tests of metals at high temperatures.

Mr. H. W. Gepp, Gen. Mgr. of the Electrolytic Zinz Co., of Australasia, Melbourne, Australia, is in New York at the Chemists' Club.

One of the warehouses of the J. G. White Engineering Corporation at the U. S. Nitrate Plant at Mussel Shoals, has been destroyed by fire, occasioning a loss of over $2,000,000.

Richard M. Colgate, Pres. of Colgate & Co., soap manufacturers, Jersey City, N.J., died at his home, Hollyoaks, Llewellyn Park, West Orange, New Jersey, in September.

Dr. Harold Hibbert, Consulting Chemist, formerly of Toronto, is returned to New York after a business trip of some months in England.

Capt. Washburn, formerly of the C. W. S., has returned from a business trip to Norway, to which country he will shortly proceed again.

Mr. Donald R. Staddon, of D. R. Staddon & Co., analytical and consulting chemists, New York, is in England on business.

Messrs. Holmes and Hall, of the engineering staff of E. B. Badger & Sons Co., Boston, are stationed at Erie, Pa., erecting an alcohol recovery plant.

Dr. John E. Teeple, consulting chemist, New York, is Acting-Treasurer of the American Chemical Society following Dr. E. G. Love's death.

COPPER DEVELOPMENT IN NORTHERN MANITOBA.

It is the opinion of many that Canada is about to experience a wonderful development of her copper resources. The latest factor in the situation is the purchase by Hayden, Stone & Co., of New York and Boston, the largest low-grade copper operators in the world, of the Flin Fon Mine in Northern Manitoba. Toronto mining interests are also involved in the sale of the mine. The six prospetors who discovered the Flin Fon owned one-third; John E. Hammell, Toronto, one-fourth; Frank Currie, Toronto, one-eighth; Alex. Fasken, Toronto, one-eighth; and Daniel Fasken, Toronto, one-eighth. Up to the present 20,000,000 tons of ore have been blocked out, and 42,000 feet of diamond-drilling has been done. For a distance of over 2,100 feet in length on the vein and a depth of 900 feet, the ore from the surface assays to the depth of 900 feet did not vary one per cent. on the assays. The copper contents of the ore body are 1.87 per cent., $1.80 in gold and 1½ ounces in silver, 3½ per cent. zinc, and 38 per cent. sulphur. The value of the ore body so far blocked out for copper, gold and silver is, approximately, $200,000,000. The cost of treating this ore will be in the neighborhood of $5 a ton.

The Flin Fon Mine lies 80 miles northwesterly from The Pas, Manitoba, 600 miles northwest of Winnipeg, and on the boundary line between Manitoba and Saskatchewan. At the present time the prospects for a railway to the mine are in doubt, but it is understood, according to Mr. John W. Callinan, of the Callinan-McKay Exploration Co., of Pittsburg, Pa., who has been doing exploration work on the mine for over three years, that in the event of the Canadian National Railways failing to construct a railway to the mine, that Hon. Edward Brown, Treasurer of Manitoba, has promised that the Province of Manitoba will build a line. The Canadian Pacific, Mr. Callinan stated, had applied for a charter to build to the Flin Fon Mine, but were refused on the ground that the Canadian National Railways claimed the territory.

It is the intention of the company, Mr. Callinan stated, to do all the work right at Flin Fon, including the smelting and refining to the finished product. The Mandy Mine, situated near the Flin Fon, has hauled out already $3,000,000 worth of copper ore, which has been shipped all the way to the Trail Smelter, B.C., for treatment, and runs 22 per cent. copper, $3 per ton in gold and $1 in silver.

There is another new find on the northeast arm of Schist Lake, with a vein four feet wide of 15 per cent. copper ore, carrying $3 in gold and about $2 in silver. This is optioned to Charles W. Greenlee, of Duluth, who is now sinking a shaft and opening the property up.

The Flin Fon was discovered be Thomas Creighton, an Ontario prospector from the Rainy River district.

The report of Commissioner R. C. Wallace of Northern Manitoba, on the Copper Lake region, which lies 35 miles due east of the Flin Fon, bears out the statements of prospectors that the whole region in that section of Manitoba is rich in mineral deposits. His report dealing with the Copper Lake district is as follows:

"The importance in itself of the gold shoot on the Red Rose claim cannot at the present moment be accurately estimated, owing to the fact that no considerable body of quartz has yet been uncovered in the line of strike in which the shoot appears. It is, however, significant as indicating the presence of gold in quantity at one place in a district where quartz and iron surphide bodies are so extensively developed, and particularly owing to the fact of its close proximity to an extensive quartz lode, preliminary sampling of which shows very encouraging results. The district is somewhat restricted in area, though the limits of narow tongues of greenstone, which extend northeast and southwest from the area, have not yet been fully defined. There is a remarkably diversified mineralization with this area. The gold showing on the Red Rose points to the fact that at the time of the mineralization which affected the large quartz bodies, as well as the smaller veinlets, very considerable gold was being carried into the quartz. The quartz and iron sulphide lodes should be thoroughly investigated by companies which are prepared to handle development work on an extensive scale."

SHAWINIGAN CLOSES BIG CONTRACT.

One of the most important developments in the history of the Shawinigan Water & Power Co. of Shawinigan Falls, Quebec, was made on the eighth day of October last, when a long-term contract was closed by this well-known Canadian power concern with the International Paper Co. for electric power for the latter's requirements. This is a great forward step in the steady progess that has marked the activities of the Shawinigan Water & Power Co. ever since its inception. At the outset some 20,000 horsepower is to be supplied to the International Paper concern for consumption at the new pulp and paper plant of the United States Corporation, which is situated at the confluence of the St. Maurice and St. Lawrence Rivers, and which is to have an initial output of newsprint of some 200 tons daily. As the production of the plant is added to from time to time additional energy will be taken from the Shawinigan power development plant, and it is expected that 30,000 horsepower will be consumed by the paper enterprise within a short time after its inauguration.

After a thorough survey of the power situation, an element so vital to the economical and successful operation of a modern pulp and paper undertaking, the executive of the International Paper Co. decided that it would be more advantageous to enter into a long-term arrangement with the Shawinigan Development than to proceed with the exploitation of water powers on the St. Maurice River, of which the American concern possessed valuable and extensive rights. The latter, it is understood, have been disposed of to the Shawinigan interests under the terms of the new agreement.

JAPAN INCREASES FERTILIZER PRODUCTION.

The Government of Japan is helping the domestic production of chemical fertilizers in order to increase the output of agricultural products. Sodium nitrate is the only fertilizer Japan cannot produce heavily, and this she imports from Chile to the amount of 60,000 tons annually. Oil cakes of various kinds are the most important fertilizers used by Japan at present.

Canadian Government Publications

By S. J. COOK, B.A., A.I.C., PUBLIC ANALYST, DEPARTMENT of TRADE and COMMERCE, OTTAWA

(NOTE: Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

THE HONORARY ADVISORY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

Bulletin No 7.. The Manufacture of Ethyl Alcohol from Wood Waste. By G. H. Tomlinson, B.A. 9 pp. Those who heard Mr. Tomlinson at the first convention of Canadian chemists in Ottawa last year will recall this paper, which was then presented. In an appendix to this paper, written for inclusion in the present bulletin, the author sums up the Canadian situation to-day, thereby bringing the address up to date. The principal part of the paper deals with a review of the process by which the wood is converted into fermentable sugars and thence into alcohol. Mr. Tomlinson was intimately connected with the work which resulted in the establishment of the plant at Georgetown, S.C., the first commercial enterprise of its kind in America, and also with the plant at Fulleton, La., which was built later. The data for this report are therefore drawn from original sources, which lends authority to the review. It is shown that alcohol has been, and can be, made more cheaply from wood than from grain, and the methods of work as well as a table of costs are given. In the appendix, the present anomalous situation existent in Canada is rather scathingly noted thus: "Before anything is likely to be accomplished, however, out antiquated regulations governing the manufacture and sale of alcohol must first be revised, so that alcohol can be made and sold for industrial purposes without the needless restrictions now imposed. Proper legislation of this kind would also stimulate industrial activity along many other chemical lines, which are now closed to development in Canada as a result of our shortsighted policy in this connection, and for which there is apparently no excuse now that potable alcohol ceases to be a major source of revenue in this country."

COMMISSION OF CONSERVATION.

Pulverized Fuel—Its Use and Possibilities. By W. J. Dick, M.Sc. 58 pp. 7 plates. The shortage of coal during recent years in Canada, coupled with the fact that our Canadian reserves are estimated to hold about 17 per cent. of the world's supply have directed the attention of many scientists in this country to the desirability and, in fact, the necessity of opening up new sources of fuel in Canada, and of better utilization of our present supplies. Pulverized fuel is one of the new developments which it seems practibable that we should use. In this publication from the Commission we have a review of the situation and a description of the installation in which pulverized fuel is used. Dominion Coal Co. is said to be the first in Canada to put in this system, and the literature of the Bettington boilers which were used in the New Waterford, N.S., plant is quoted at length. A drawing accompanies the description. Quite a number of users of pulverized coal were written to in connection with the collection of material for this report, and the replies to the letters are given in full. Besides this, the many illustrations show the general appearance of the installation, and the drawings show the general design. The bulletin is a timely publication and every chemist will read it with pleasure and most of them with profit.

DEPARTMENT OF TRADE AND COMMERCE.

Twenty-seventh Annual Report of the Department of Trade and Commerce. Year ending March, 1919. 44 pp. The activities of this big department of the government service makes interesting reading and this report reviews in brief the work that has been done in connection with the development of Canada's trade at home and abroad. The story of the big purchases made in Canada by the Allies is given and the part played by the department in the cultivation of trade is shown to have been very creditable. The work of the many branches is reviewed in a series of short articles and some suggestions for the better operation of Canadian industries are offered.

Commercial Intelligence Branch.—Index to the Weekly Bulletins for the Six Months Ending June, 1919. 19 pp. (Weekly Bulletins Nos. 780-804.)

Weekly Bulletins Nos. 818-820.—Pages 660-664 carry a review of the report of the committee of the Privy Council for Scientific and Industrial Research for the year ending July, 1919, by Acting Trade Commissioner at London. Page 669. Review of the work of the Catalogue and Sample Room at Liege. All catalogues and other matter are reviewed weekly in the local press by the British Vice-Consul. Pages 702-704. British Engineering Standards Association publications available through the Canadian Engineering Standards Association. Page 770. List of the more important articles exportable from Canada to Japan.

Dominion Bureau of Statistics.—Monthly Report of the Trade of Canada. August, 1919. 428 pp. Imports for consumption for the month of August this year amounted to $81,357,385, while for the same month last year the import figures were $79,940,182. Exports this year of Canadian produce stand at $116,564,792 and of foreign produce $4.313,801; the corresponding figures for the month last year being $88.353,999 and $4,449,609. Thus the aggregate trade for the month this year is $202,235,978 as compared with $172,743.679 for August last year.

DEPARTMENT OF THE INTERIOR.

Natural Resources Intelligence Branch.—Natural Resources of the Provinces of Manitoba, Saskatchewan and Alberta. 35 pp. A brief statistical compilation bearing on the natural resources of the three prairie provinces. Plans of lands, synopses of regulations, sketch maps, fisheries, game laws, and mineral production are given.

A complete list of the publications of the Natural Resources Intelligence Branch is available on application to the director of this branch, which is under the Department of the Interior.

The Province of Saskatchewan. Its Development and Opportunities. By F. H. Kitto, D.L.S. 153 pp. 7 maps, 4 charts, 10 illustrations. To the intending settler or visitor to Saskatchewan this little book is full of interest, and to those others who have not as yet visited this central prairie province it will bring a little of the lure of the West. Mr. Kitto has spent a good deal of time in the province he describes, and therefore writes the more interestingly because his knowledge is largely firsthand. Almost every phase of the activities found there is described and the publication is replete with information set down in readable style. The

bulletin is well printed and illustrated, and altogether attractive.

Report of the Director of Forestry for the Year 1918. 70 pp. 13 illustrations. In addition to the general report of the Director of the tree-planting division, the district inspectors of forest reserves for Manitoba, Saskatchewan, Alberta and British Columbia. The superintendent of the Forest Products Laboratories at Montreal also contributed a review of the work carried on there. Expenditure on forestry work in Canada on reserves under Dominion supervision is costing an average of one and three-quarter cents per acre, while in the United States the cost is three cents; in India, nine cents; in Sweden, fourteen and one-half cents, and in France ,one dollar and four cents. It is a question as to whether this represents true economy. It probably does not. The work of the Forest Products Laboratories has been disorganized and well-nigh discontinued owing to the fact that the salaries paid to the highly skilled technical men who had been assembled there were not sufficient to hold them in the government employ, and as a consequence individual firms in Canada and the United States have drawn these men into commercial life. The report reviews what has been done in the way of fire prevention in the forests of Canada, and points the way for much progress in the future in the very important field. Conservation is a study that as yet has not progressed far in Canada.

DEPARTMENT OF MINES.

Geological Survey.—Memoir 111. No. 91, Geological Series. The Silurian Geology and Faunas of the Ontario Peninsula and Manitoulin and Adjacent Islands. By M. Y. Williams. 195 pp. 2 maps, 34 plates, 6 figures. The purpose of this report is to place in the hands of those interested, up-to-date information regarding the Silurian system of southwestern Ontario. The "Geology of Canada," by Sir William Logan, published by the Geological Survey of Canada in 1863, includes the only comprehensive account previously published on this subject. This volume has so long been out of print, however, and so many advances have been made since it was written that it seemed desirable to collect and revise the data relative to this formation, and to publish it for general reference. Taken in conjunction with the report recently issued on the "Devonian of Southwestern Ontario," by Clinton Stauffer, the present memoir completes the general description and mapping of the geology of southern Ontario as far east as the areas underlain by rocks belonging to the Ordovician system. The field work on which this work was based was carried on during the years from 1912 to 1916 inclusive. The plates are excellent, being well printed from drawings which bring out the lines of the various fossils so that the distinguishing features are easily recognizable. The greater part of the book is taken up with the descriptions of the rocks, but considerable space is given to the economic values of the rocks found in the district, and the uses to which they are, or may be put are mentioned.

DEPARTMENT OF AGRICULTURE.

Flue-Cured Tobacco in Canada. By D. D. Digges and H. A. Freeman. 44 pp.

The Director, in his letter of transmittal, says regarding this bulletin: "The growing of flue-cured tobacco in Ontario has become during the last few years a well-established industry, but there has so far been very little reliable data available on the subject as to how far the growing of that type of tobacco may be carried on in Canada, where conditions differ materially from those obtaining in Virginia or the Carolinas. The bulletin is the result of much experimental work on the tobacco station at Horrow, of which Mr. Digges is the manager, and the information in that section is supplemented and widened in its scope by the report of investigations of tobacco soils in Southern Ontario made by Mr. H. A. Freeman, tobacco inspector."

The data are collected under three heads: (1) Growing flue-cured tobacco in Ontario; (2) Tobacco soils, rotation, and fertilizers; (3) Co-operative experiments. The opinion is expressed that Southern Ontario is the only place in Eastern Canada where the culture of this kind of tobacco is likely to be carried on profitably. British Columbia has not as yet been investigated. In Southern Ontario, however, it is stated that the crop is an eminently safe one.

DOMINION BUREAU OF STATISTICS.

Monthly Report of the Trade of Canada for July, 1919. 428 pp.

Imports and exports data regarding Canadian trade. Our aggregate trade for the month shows an increase over that for the corresponding month of last year, but the four-months' period ending July shows a steady decline, the figures for the period being $901,842,819 for 1917; $702,-970,394 for 1918; and $658,787,357 for 1919. The exports of Canadian produce were only slightly lower this year than for the same period in 1918, while the combined exports of domestic and foreign produce show an increase.

Census of Industry. Part IV., 49 pp. Lumber, Lath and Shingles, etc.

Statistics relating to the production of lumber and lath. and including data regarding capital investments, salaries and wages paid, power and fuel used, etc. The data are classified according to the kinds of wood and the cut by provinces for ease of reference. Appended is a directory of the sawmills operating in Canada, arranged according to provinces. The bulletin is a combined English-French edition.

COMMERCIAL INTELLIGENCE BRANCH.

Weekly Bulletins, Nos. 813-817. Sept. 1-29, 1919.

No. 815 contains a list of industries regarded by the British Board of Trade as "unstable key industries," which require the protection now afforded by the order which prohibits the importation except under licence of products similar to those produced by these key industries. The list includes coal tar intermediates, synthetic drugs, perfumes and flavoring extracts, analytical re-agents, glass, porcelain, potassium compounds, zinc oxide, lithopone, tungsten powder and ferrotungsten, thorium nitrate, etc.

FOOD AND DRUG LABORATORY.

Bulletin 432. Turpentine as a Paint Material. 8 pp.

Eighteen samples out of a collection of 114 purchased in the open market in Canada were found to be not genuine turpentine, but the Chief Analyst points out that he is unable to declare these samples adulterated under the Act owing to the peculiar wording of Section 21. Unscrupulous persons have for years availed themselves of this joker in the Act, and as a consequence it has been, and still is, somewhat difficult for the purchaser to obtain the genuine article. It is to be hoped that our lawmakers will see the error of their ways and give us laws which can

be construed to protect the public from the national parasites who have regard only to their own advantage. The restoration to the bulletin of the names of the vendors and furnishers of the samples analyzed is a return to a useful practice.

ADVISORY RESEARCH COUNCIL.

Report No. 5. Canadian Waste Sulphite Liquor as a Source of Alcohol. By Vernon K. Krieble. 14 pp.

A dozen representative Canadian sulphite liquors were analyzed, the results of which showed that the best liquors contained as high a percentage of sugar as those produced in Europe. At least 1% by volume of alcohol should be obtainable, it is stated, and this is considered good practice in Europe. Canadian liquors are found to fall into two classes, one of which has 20% of its organic matter in the form of reducible sugars, and the other 28%. This is said to be due to the difference in the length of the time of the cook and to the variation in temperature used.

DEPARTMENT OF MINES—GEOLOGICAL SURVEY.

Summary Report, 1918. Part C, 52 pp. The table of contents gives:

(1) Cretaceous, Lower Smoky River, Alberta. F. H. McLearn.
(2) Geology of the Swan Hills in Lesser Slave Lake District. J. A. Allan.
(3) Northern Part of Crow's Nest Coal Field. B. Rose.
(4) Gasoline in Natural Gas. Experiments on Alberta Gas. D. B. Dowling.
(5) Surface Deposits of Southeastern Saskatchewan. J. Stansfield.

A summary report is already a condense, and a review of such a report is not therefore usually as satisfactory as those of larger treatises. It may be said, however, that these geological survey summary reports are most readable, and although the subjects treated are all geological, they are nevertheless concerned with many phases of the subject, and are consequently of wide interest. To the chemist the work now reported on gasoline in natural gas is the most interesting, the geological and chemical data being collected in this article. The rest of the work discussed is of interest to those whose thoughts or duties take them to the regions described.

Summary Report. Part D, 19 pp.

A series of brief reports on Athapapaskaw, Reed, Elbow and Wekusko Lake Districts, together with a paper on superficial deposits and soils of the Winnipegosis area, and one on the gold quartz veins and scheelite deposits in Southeastern Manitoba. A high-grade tungsten concentrate of grade 70.63% is reported as made with a recovery of 95.7% of the tungsten values in the ores. The sample analyzed, however, was from cobbed material, and the mill test is therefore not so encouraging.

Summary Report, 1918. Part F, 36 pp.

Investigations in Western Nova Scotia are reported by E. R. Faribault, and have reference to manganese and platinum searches. Further studies in Nova Scotia and New Brunswick covering coal, iron, zinc-lead-copper, manganese and salt were made by A. O. Hayes, and are herein described. The third paper is by A. Anrep, and is a record of investigations carried on in New Brunswick on the subject of peat.

Summary Report, 1918. Part G, 19 p.p.

Of special interest to chemists is this report by J. J. O'Neill, which is a review of the platinum situation in Canada. In his summary Mr. O'Neill says: "Canada certainly has possibilities of becoming one of the world's largest producers of metals of the platinum group. At the present time the production is reported at less than 100 ounces per annum, but the figures presented seem to show that there are probably more than 50,000 ounces of the platinum metals contained in ores mined in Canada each year from which no recovery is reported. All the information to hand points out that a very large amount of this material is lost, from one cause or another. It is entirely reasonable that the Government should inquire what becomes of this material, which represents a value at present prices of over $5,000,000, and which up to the conclusion of the war was so vital in its prosecution.

Correction.—The statement made in this column in the August issue that the bulletin on Mineral Waters then reviewed was the first one recording Canadian work was obviously erroneous, as a previous bulletin, published by the Mines Branch, had been reviewed more than a year ago.

RECENT INCORPORATIONS.

NOTE.—The following companies have recently been incorporated. For business purposes, communicate with the head office of the company, which is always at the city mentioned.

Montreal.—Paxton-Mitchell, Limited. Capital, $100,000. To manufacture and deal in iron, steel, and other metals; and machinery.

Montreal.—Engineering Service, Limited. Capital, $20,000. General engineering business.

Farnham, Que.—Salem Oil and Grease Co. of Canada, Ltd. Capital, $45,000. Manufacturer and dealers in oil, soap, grease, and lubricants of all kinds.

Montreal.—Canada Brass Products, Ltd. Capital, $50,000. Iron and brass founders.

Toronto.—Canada Bitulithic, Ltd. Capital, $1,500,000. General engineering work.

Montreal.—General Iron and Metal Company, Ltd. Capital, $19,000. To manufacture, refine and smelt, babbit, solder, brass, lead, zinc, etc.

Toronto.—Chemical Products Corporation, Ltd. Capital, $3,000,000. Manufacturers and dealers in drugs, chemicals, fertilizers, colors, dyes, dye-tsuffs and products, by-products and derivations thereof.

Lakefield, Ont.—The Colonial Glass Co., Ltd. Capital, $50,000. To take over present business of the Colonial Glass Co. of Lakefield, and to manufacture and deal in all kinds of glass.

Montreal.—Sun Company of Canada, Ltd. Capital, $100,000. To mine and produce petroleum oil and natural gas.

Guelph.—The Dominion Food Products Co., Ltd. Capital, $50,000. To manufacture and deal in essences, vinegars, preserves, yeast, cereals and food-products.

Toronto.—North American Dye Corporation, Ltd. Capital, $250,000. Manufacture and deal in dyes, dye products, chemicals, oils, paints, soaps, etc.

Toronto.—Canadian John Wood Manufacturing Co., Ltd. Capital, $200,000. To manufacture iron or steel, tanks, boilers, etc., iron and brass founders.

Toronto.—Westcoast Mining Company, Ltd. Capital, $50,000. General mining and smelting business.

Montreal.—Lariviere, Limited. Capital, $45,000. To pur-

chase present business of Lariviere, Ltd., and to manufacture and deal in alcohol, acids, ether, wines, vinegars, etc.

Toronto.—Dodge Manufacturing Co., Ltd. Capital, $300,000. Manufacture and deal in machinery, drop forgings, pulleys, structural steel, etc.

Hamilton.—The Bull Dog Lacer Company, of Canada, Ltd. Capital, $50,000. Manufacture and deal in iron, steel, and all metals from the ore to th efinished product.

Montreal.—Yeates Machinery and Supply Co. Capital, $100,000. To take over present business of Yeates Machinery and Supply Co., and to do a general business as iron and steel merchants and machinery manufacturers and dealers.

Montreal.—Katzenbach and Bullock Co., Ltd. Capital, $50,000. Manufacture and deal in chemicals, acids and alkalines.

BUSINESS CONNECTIONS FOR CANADIAN EXPORTERS.

(The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, the Department of Trade and Commerce, Ottawa." In writing, correspondents should quote the number of the inquiry. The initials, "B.T.C.," indicate British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.)

2102. **Ores.**—A Belgian importer inquires for Canadian ore shippers—copper, nickel, silver, cobalt, tungsten and molybdenum.

2103. **Electric Batteries.**—An importer at Galaroza (Huelva), Spain, inquires for Canadian manufacturers or exporters of electric batteries.

2118. **Mineral Products.**—A Sheffield, England, firm wants cobalt, nickel and ferro-alloys.

2124. **Amber Glass Bottles.**—A London, England, firm wants names of Canadian manufacturers of these bottles.

2128. **Crude Methyl Alcohol.**—An English firm wants names of Canadian manufacturers of crude methyl alcohol.

2129. **Chemicals, Metals, Railway and Engineering Supplies.**—London, England, firm desires to hear from Canadian manufacturers and shippers seeking export connections.

2133. **Molybdenum.**—A London, Eng., firm.

2135. **Acetate of Lime.**—A New York firm is in the market for a carload every five days over a period of six months.

2141. **Chemicals, Ores, Metals, Gas and Electric Apparatus, Railway Equipment.**—A French importer seeks to represent Canadian firms in these lines.

2144. **Acetic Acid, Fish Oil.**—An importer at Genoa, Italy.

2148. **Chemicals, Lubricants, Electrical and Engineering Goods.**—A mercantile house in Atmedabav, India.

2170. **Dynamos, Electric Equipment.**—A Liverpool firm.

2174. **Glass Bottles, Chemical Glassware.**—A London, Eng., firm.

2175. **Aluminium, Bronze Powder, Tinfoil.**—An Australian firm.

2177. **Fertilizers, Oils, Pumps, Salt, Tiles.**—A large Australian-New Zealand company with head office in London.

2231. **Cement.**—South African firm wishes agency for a Canadian cement.

2241. **Chemicals and Drugs.**—An agency wanted for drugs of all descriptions.

2245. **Glass and Earthenware.**—An agent in Barbados wishes to represent these lines.

2249. **Plated and Silverware.**—An agent in Barbados wishes to represent these lines.

2263. **Alcohol.**—A Brussels, Belgium, firm.

2264. **Industrial Alcohol.**—A Liege, Belgium, firm.

2755-2758. **Mineral Waters.**—Four Belgium concerns wish to get importations.

2761. **Asbestos Woven Cloth.**—A Glasgow firm.

2765. **Metal Bronzing Powders.**—A firm in Melbourne, Australia.

2766. **Chemicals for Soapworks, Tanneries, Dyeworks, Woolen Mills, Baking Powder Works and Freezing Companies.**—A firm of importers in Auckland, New Zealand.

2788. **Magnesium Powder and Aluminium Bronze Powder.**—A firm in Oports, Portugal.

2816. **Glass Bottles.**—A London drug company.

2834. **Acetic Acid.**—A Manchester firm wants crude acetic acid, 92 per cent. Samples should accompany lowest prices.

2835. **Lead.**—Genuine dry white lead and dry red lead wanted by Manchester firm. Samples necessary.

2836. **Wood Alcohol.**—A manchester firm. Prices must be c.i.f. Liverpool, Manchester or Glasgow.

2840. **Aluminiumware.**—South African firm.

2848. **Chemicals.**—An importer in Paris, France, wishes to represent Canadian chemical exporters.

2849. **Tinplates.**—A firm in Osoka, Japan.

2858. **Chemical Products and Dyestuffs.**—A company in Salonica, Greece.

2871. **Sheet Steel.**—A glasgow firm wishes to export sheet steel to India and Australia.

2916. **Electric Welding Wire.**—A Midlands, Eng., firm.

2919. **Porcelain Insulators, Insulating Materials, Copper Wires and Fibre.**—A London firm.

2922. **Brewing Malt.**—Importer in Geneva, Switzerland, wants 500 tons of Canadian brewing malt. Quotations must be c.i.f. Antwerp, with absolute guarantee of delivery.

ELECTRIC FURNACES INSTALLED.

A 50-kilowatt electric furnace, of 500-pound capacity, manufactured by the Electric Furnace Co. of Alliance, Ohio, has been installed in the plant of the Dominion Steel Products Co. at Brantford, Ont. The furnace will be used for yellow brass. It is interesting to note that the Electric Furnace Co. have just installed in their own plant nine of their new Bailey electric furnaces for melting a wide range of nonferrous metal and other alloys. Six well-known American firms have recently installed Bailey furnaces.

TO COMMENCE MAKING BRIQUETTES.

Mr. J. M. Leamy, of the Lignite Board, has announced that the manufacture of briquettes will commence at the plant at Estevan, Sask., during 1920. The Estevan plant is to be constructed jointly by the Dominion, Manitoba and Saskatchewan Governments, with the object of demonstrating that briquettes can be produced economically and scientifically. Machinery is being puchased for the plants that will enable 30,000 tons a year to be produced. "We believe that the briquettes will be equal to the best coal, and hope to be able to sell them at $10 per ton in Winnipeg," said Mr. Leamy. When the industry has been well started it will then be left to either public or private capital to develop.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Process of Extracting Solids.

E. E. Howson, 192287, August 26, 1919.

Briquet Machine.

S. E. Moren, 192862, September 23, 1919.

Electrolytic Cells.

C. P. Townsend, 192228, August 19, 1919. A cell for producing Cl has means for maintaining atm. or lower pressure within the gas-space of the cell and means below the surface of the electrolyte for collecting the evolved Cl before it reaches the gas-space.

Detergent.

Robert E. Divine, 192488, September 2, 1919. A detergent suitable for use in hard water and readily soluble in an equal volume of water.

Expressing Liquid from Material.

J. W. Hinchley and C. S. D. Harper, 192804, September 23, 1919. For peat or similar material.

Briquet Machines.

G. Komarek, 192907, September 23, 1919. A briquet machine, consists of a pair of pressure drums provided in their peripheries with circumferentially disposed rows of mold covities, and chains carried by one of the drums and disposed between the rows of mold cavities.

Material Feeder for Briquet Machines.

G. Komarek, 192908, September 23, 1919. The feeder has a pressure roll in the periphery of which is formed circumferentially disposed grooves.

Treating Nitre Cake to Form the Normal Sulphate.

Jas. Beveridge, 192815, September 23, 1919. $NaHSO_4$ is heated with C at a temperature sufficient to convert the acid content of the cake into Na_2SO_4 and to decompose any free acid. The SO_3 gases are absorbed in water to form acid of the remaining SO_2 absorbed in an alkali metal compound containing O and capable of forming a sulphite.

Spring Steels.

C. H. Willis, 192341, August 26, 1919. A steel alloy is composed of Fe combined with 0.38 to 0.55% C., 0.40-1.25% Mn, 2% or less Cr, 0.10-0.40% Si and 1% or less Mo. The alloy has a tensile strength of 201,000-270,000 lbs., and elastic limit of 180,000-225,000 lbs., and an elongation of 7 to 15% and a reduction of area of 17 to 45% may be obtained. The alloy may be readily worked and is particularly adapted for spring manufacture.

Potassium Chlorid.

E. E. Dutt, 192492, September 2, 1919. Feldspar is heated and treated with $AsCl_3$. KCl is dissolved from the resulting mass and the solution evaporated.

Electric Furnaces.

Otis Hutchins, 192899, September 23, 1919. This furnace is specially adapted to the manufacture of abrasives.

Regenerating Mercury Catalysts.

H. A. Morton, 192761, September 16, 1919. The exhausted catalyst is subjected to the action of Cl to convert the Hg into $HgCl_2$, which is recovered from the resulting mixture and converted into the desired catalyst.

Pyridine Bases.

F. E. Dodge and F. H. Rhodes, 192347, August 26, 1919. The process relates to the recovery of pyridine bases from the saturator baths of the direct or semi-direct $(NH_4)_2SO_4$ process.

Catalytic Oxidation of Benzene.

Jno. M. Weiss and Chas. Downs, 192766, September 16, 1919. V oxide is used as a catalyzer and a temperature below 550° employed. $C_2H_2(CO_2H)_2$, CHOH and CO_2 are given as the products of one operation.

Boron Derivative of Pyrophosphoric Acid.

B. Levin, 192071, August 12, 1919.

Alloy Steels.

C. H. Willis, 192340, August 26, 1919. A steel alloy is composed of Fe with C.O.20-0.35%, Mn 0.30-0.125%, Si 0.15-0.35%, Cr. 1.20% or less and Mo. 1% or less. Suitable for forgings to be worked at high temperature.

Treatment of Certain Fuels to Improve Their Calorific Value.

Wm. A. Bone, 192816, September 23, 1919. Brown coals and lignites are heated to a temperature between 250-400° C. until water substantially ceases to come off, and under conditions which prevent exothermic reaction sufficiently vigorous to raise the temperature above 400°.

Process of Making a Commercial Form of Fuel from Lignite.

F. D. McClure, 192864, September 23, 1919.

Smelting of Ores and Metals.

O. C. Bockman, 192154, August 19, 1919.

Reduction of Ores.

O. C. Bockman, 192155, August 19, 1919.

Flotation, Ore Separating Apparatus.

A. L. Blomfield, 192049, August 12, 1919. The apparatus includes an air-lift for transferring material from the bottom portion of the settling vessel to an elevated point of discharge. The frothing zone overflows into the settling zone through a restricted passage formed by an annular baffle spaced from the partition between the settling zone and frothing zone.

Machines for Extracting Liquids from Various Materials.

C. D. Jenkins, 192847, September 23, 1919.

Separating Emulsified Liquids.

C. W. McKibben, 192716, September 16, 1919. The associated liquids are heated to a temperature below the b.p. of the mixture and passed through a path between suitably energized electrodes at a velocity sufficient to prevent the persistance of chains of polarized globules of the entrapped liquid after they have been formed into nascent streams between the electrodes. The effective E.M.F. of the current is reduced automatically when the streams begin to form.

Flotation Apparatus.

Wm. L. Ziegler, 192111, August 12, 1919. A stream of ore pulp is subjected to frothing with air, the froth is subjected to beating in a closed chamber to break up the larger air bubbles and produce a creamy froth which is then subjected to flotation to separate gagne and heavier particles.

Furnace Linings.

G. W. Patnoe, 192126, August 12, 1919. A refractory material for furnace linings is made by adding 2 to 5% of argillaceous material in the form $SiO_2Al_2O_3$ and FeO to magnesium limestone.

Electric Furnaces.

H. A. Greaves, H. Etchells, 192655, September 16, 1919.

Welding Tungsten Ingots.

Carl Pfanstiehl, 192001, August 5, 1919.

Process for the Manufacture of Sulphuric Acid.

L. P. Basset, 192662, September 16, 1919. Gases containing SO_2 and O are passed through a catalytic substance capable of partially oxidizing the SO_2, the oxidized portion is removed and the recurring SO_2 is absorbed in a calcareous material suitable for making cement. The catalyst may be natural hydrated iron oxide mixed with gypsum.

Apparatus for Welding Tungsten Ingots.

C. A. Pfanstiehy, 192363, August 26, 1919.

Electrolytic Deposition of Metals.

N. H. M. Dekker, 192268, August 26, 1919. The electrolyte is formed by heating a salt by a steam jet so that the salt is dissolved only in its water or crystn.

Sulfonated Mineral Oil Sludge Product.

Robert E. Divine, 192487, September 2, 1919.

Mineral Oil Sulphonic Acid.

Robert E. Divine, 192486, September 2, 1919.

Catalytic Heating Apparatus.

Ramon Camell, Laurent Cochet and Jos. Gritte, 192790, September 16, 1919.

JAPAN'S TIN-PLATE INDUSTRY.

In Japan the demand for tin plate is continually increasing. The manufacture, however, cannot be pursued profitably in that country. Most of the imports come from the United States. In 1916 about 65,000 pounds were imported, but thereafter the annual shipments were reduced to 40,000 or 45,000 pounds, owing to the war. Since the proclamation of the armistice imports have been showing a slight decrease, and are not sufficient to satisfy the demand in Japan. It is reported, according to the Japanese Chronicle, that one of the big steel works has for some time past been carrying on experimental work in the manufacture of tin plate, and the results are so promising that commercial manufacture is soon to be started and the product put on the market.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

The tendency in the market in chemicals in Canada throughout October has been from steady to strong. There has been no weakening of prices, nor has there been any marked jump except in some of the drugs, such as quinine, for instance, which jumped from $1.35, the price received at Toronto on September 30th, to $1.75 to $1.80, the price current on November 1st. So far as sales go, the market has been, taking it on the whole, fairly quiet in the weaker lines, but decidedly good and active in heavy chemicals. Acids have remained steady, and there will not be any weakening of prices in acids this coming winter, nor, indeed, in any chemicals. The opinion among the leading manufacturers gathered at the Chicago Exposition in September was that there would be no weakening of prices this season. The cost of readjustments after the war, the wage increases, the increased overhead, all conduce to making any lowering of prices impossible, except in a few of the weak chemicals in which slight drops are bound to occur.

Soda Ash.—During the past month the announcement was made that the Brunner, Mond, soda ash plant at Amherstburg, Ont., had reopened. This is a matter of some congratulation to all interested in the continued progress of chemical industries in Canada, and we sincerely hope, and we believe, that the Amherstburg plant has reopened to stay open.

U.S. Dye License Bill.—Following months of many moves, the Longworth dye bill, making it necessary for foreign dyes (including German and British) to secure a license to enter the United States, passed the United States Congress on September 26, by 156 to 119, and it is now before the Senate for final sanction. The debate in the Congress on the bill was one of the bitterest staged in recent years on a tariff measure.

Laboratory Apparatus.—Business in chemical laboratory supplies at Toronto and Montreal has been exceptionally good during the past month. Dealers are decidedly optimistic, and the fact that the laboratory supply business is good speaks well for the general advancement of scientific business in this country, or at least of industries based on scientific management and control. Industries in Ontario that have recently installed laboratories are: The Pilkington Glass Works, at Thorold; the Anglo-Canadian Leather Co., at Huntsville; Canadian Oriental Textile Co., Oshawa; and the Electro Tin Products Co., Brantford.

METALS.

Lead and Zinc.—Considerable optimism as to Canada's future in the lead and zinc markets of the world prevails to-day as a result of the report received from President J. J. Warren, of the Consolidated Mining and Smelting Co., who is at present in Europe concerned with the prospects for Canadian lead and zinc markets there. Mr. Warren is convinced that splendid markets for Canadian lead and zinc are to be had, both in Great Britain and on the Continent, as well as in India and Africa. It is said that of the world's annual demand for zinc of nearly 800,000 tons, Canada produces only some 25,000 tons, whereas the Dominion is in a position to produce 10 per cent. of the total world demand. There is, beyond question, great possibilities for Canadian zinc and lead, and it might be noted here that already Canada is supplying a strong demand for these metals in Japan.

Ferro-Alloys.—After investigations by the Department of Trade and Commerce, Ottawa, through the Commissioner-General of Canada in France, it would appear that there is no export market in France for Canadian producers of ferro-chrome and ferro-molybdenum. Canadian manufacturers of these alloys were naturally anxious to dispose of their surplus stocks which the ending of the war left on their hand, but, in France at any rate, there appear to be no prospects for a market. Undoubtedly export outlets are necessary to success for a Canadian ferro-chrome industry, as there is not the demand sufficient in Canada alone to sustain the industry. During the war, chrome mining operations in the Eastern Townships in Quebec were speeded up, but there has been difficulty in finding a market for the surplus stocks, although large quantities of the ordinary and concentrated ore were shipped to the United States. The Minister de la Reconstruction Industrielle of France, in reply to the Canadian commissioner, wrote:—"I beg to inform you that France has always been an exporter of ferro-chrome, both ordinary and refined, the production of its factories greatly exceeding the national consumption. Our electro-metallurgical works also manufacture the other ferro-alloys, tungsten, molybdenum, nickel, etc., in sufficient quantities."

Asbestos.—While last year was a very successful one for the asbestos producers of Canada, next year, from present indications, will be even better. The success of Canada's export business in asbestos next year depends, of course, on the rapidity with which financial and shipping arrangements with Europe can be made. There is no question as to the demand. Europe is absolutely bare of asbestos, and Canada must supply the greater part of her need. The demand from Germany and Austria is bound to come, though owing to financial conditions it may be rather retarded, but come it will. The Asbestos Corporation, the leading producers of asbestos in Canada, had an excellent year of business in 1918, and even better results are expected when the totals for 1919 are completed.

Steel.—While the United States steel strike did benefit Canadian steel mills to some extent, yet, take it on the whole, the benefit to Canadian plants was not as great as at first expected. Indeed, it has proved a set-back in many ways. Although it is a fact, as we stated last month, that some good orders were sent to Canadian plants as a result of the strike, yet in those lines where steel plates were wanted, the strike had the effect of shutting off the supply of plates, practically all of which came from the United States, and, as a result, work that demanded both plates and other kinds of steel besides, was held up, and the Canadian mills could not secure much new work, even in their own lines, as it was generally useless to commence construction work if plates were not available. That may be said to be the general situation, yet there are instances where the plates and bars have been coming into Canada from American plants in fairly large quantities, despite the strike. However, take it on the whole, the trade is more or less marking time in Canada, or at least not attempting to advance until the great strike is over, when it is generally felt by all interested that a good and extensive buying period will set in.

Coniagas Reduction Company.—The Coniagas Reduction Company ranks, perhaps, os one of the most consistent

dividend-payers of any of the mining or smelting companies of Canada. It is one of the oldest producers of the Cobalt Camp. In 1918 the Coniagas disbursed 12½% dividends, amounting to $500,000. Total disbursements made by this company now total 236%, amounting to $9,740,000.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	$ .. — .75
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.04½—.05½
Acetic acid, refined	Lb.	.18½—.19½
Acetone	Lb.	.18½—.23½
Aspirin, in 100-lb. lots	Lb.	1.20— 1.25
Alcohol, pure, bbl., 65% O.P.	Gal.	.. 8.25
Alcohol, methylated, bbl.	Gal.	.. 1.35
Alcohol, wood, 95%, refined, bbl.	Gal.	2.25— 2.50
Alum, Ammonia, lump	100 Lbs.	.. 5.75
Aluminium Sulphate, high grade, bags	100 Lbs.	3.25— 3.50
Ammonia, Aqua 26	Lb.	.09— .12
Ammonium Carbonate	Lb.	.. .17
Ammonium Chloride	Lb.	.15— .20
Amyl acetate, technical	Gal.	5.00— 5.50
Amyl acetate, pure	Gal.	6.00— 6.50
Arsenic	Lb.	.. — .09
Barium Sulphate (Barytes)	Per Ton	38.00—40.00
Benzoic Acid	Lb.	.. 1.15
Bleaching Powder, 35% drums	100 Lbs.	3.25— 3.50
Borax, crystals	Lb.	.10— .11
Boric Acid, powdered	Lb.	.17— .18
Calcium Carbide, in carload lots	Per Ton	.. —85.00
Calcium Carbide, per single ton	Per Ton	.. —90.00
Calcium Carbide, less than ton lots		.. —96.00
Calcium Chloride, fused	Per Ton	26.00—30.00
Carbolic Acid, white crystals	Lb.	.25— .26
Carbon Bisulphide, in drums	100 Lb.	.. — .10
Carbon tetrachloride, drums	Lb.	.20— .24
Caustic Soda, ground, bbl.	Lb.	.04¾—.05¼
Chloroform	Lb.	.. — .75
China Clay, imported	Per Ton	20.00—25.00
Citric Acid, domestic, crystals	Lb.	.. — 1.15
Cobalt Oxide, black	Lb.	— 1.50
Copper Sulphate (Blue Vitriol)	Lb.	.10—.10½
Formaldehyde	Lb.	.. — .28
Formic Acid, 75%	Lb.	.40— .42
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fusel oil, special	Gal.	5.00— 5.25
Fusel oil, refined	Gal.	6.00— 6.25
Glycerine, drum, C.P.	Lb.	.. —.24½
Hydrofluoric Acid, 60%	Lb.	.. — .22
Hydrofluoric Acid, 30%	Lb.	.. — .11
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16— .18
Lithopone	Lb.	.09½—.10½
Magnesite, calcined	Per Ton	.. —25.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl.	Lb.	.18— .22
Magnesium Sulphate	Lb.	.04¼—.04½
Magnesium Sulphate, B.P.	Single Ton	.. —70.00
Magnesium Sulphate, B.P., in car lots	Ton	.. —50.00
Muriatic Acid, 18 to 22	100 Lb.	2.00— 2.85
Naphthaline flake	Lb.	.10— .11
Nitric Acid, 36 carboys	100 Lb.	.08¾—.09½
Oxalic Acid	Lb.	.35— .37
Oleic Acid	Lb.	.. — .23
Potassium Bicarbonate	Lb.	.. — .41
Potassium, Bromide, crystals	Lb.	.. — .88
Potassium, Bromide, granular	Lb.	.. — .82
Potassium Hydroxide (Caustic Potash, 100 to 500-lb. lots		.. — .44
Potassium Hydroxide (Caustic Potash), 25 to 100-lb. lots		.. — .42
Potassium Hydroxide (Caustic Potash). Sticks		.. — 1.50
Potassium Nitrate, kegs	Lb.	.22— .24
Potassium Permanganate, bulk	Lb.	.75— .85
Phenacetin	Lb.	3.10— 3.25
Quinine	Oz.	.. — 1.80
Salicylic Acid	Lb.	.75— .90
Silver Nitrate	Lb.	12.00—14.00
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.14— .16
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.34— .35
Sodium Nitrate, refined	100 Lbs.	6.75— 7.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.00— 5.50
Sodium Benzoate	Lb.	1.00— 1.10
Sodium Bicarbonate, 100% pure	100 Lb.	3.50— 4.00
Sodium Bicarbonate, bbls.	Lb.	.19— .20
Sodium Nitrite	Lb.	.15— .16
Sodium Hyposulphite, kegs	100 Lb.	.. — 4.15
Sodium Silicate, according to density	100 Lbs.	3.00— 3.50
Sodium Sulphate (Glauber's Salts) crystals	Per Cwt. in Bags	.. — 1.85
	Per Cwt. in Car Lots	.. — 1.60
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.00— 4.25
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.50— 2.70
Sumac extract liquid, dark	Lb.	.. — .08
Sumac, extract liquid, colorless	Lb.	.. —.17½
Sumac, powdered	Lb.	.31— .35
Sumac, extract, No. 2	Lb.	.. —.10½
Sodium Bisulphite, 35	Lb.	.. —.02½
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Lb.	.. —17.00
Tannic Acid, commercial	Lb.	.70— .75
Tartaric Acid, crystals or powdered	Lb.	.75— .80
Tin Chloride, crystals	Lb.	.47— .50
Zinc Sulphate, com.	Lb.	.. —.07½
Zinc Dust	Lb.	.13—.14½

Metals.

Aluminium, No. 1, 98-99%	Lb.	.44— .46
Antimony	Lb.	.. — .10
Brass, yellow ingots	Lb.	.. — .20
Brass, red	Lb.	.. —.23½
Cobalt, metal	Lb.	.. — 2.50
Cobalt Oxide, grey	Lb.	.. — 1.70
Copper, casting	Lb.	.. — .24
Copper, electrolytic	Lb.	.. — .25
Copper, electrolytic, in car lots	100 Lb.	.. .25½
Iron, common	Base Price 100 Lb.	.. — 5.00
Lead	Lb.	.. —.07½
Lead, in car lots	Lb.	.. — .06
Magnesium	Lb.	1.75— 2.25
Mercury	Lb.	.. — 2.50
Nickel, shot or ingot	Lb.	.40— .45
Platinum, pure	Oz.	1.47— 1.50
Silver, bar (U.S. Govt. price)	Per Troy Ox.	.. —1.23¾
Spelter	Lb.	.. — .10
Spelter, in car lots	Lb.	.. — .08
Steel, mild	100 Lb.	.. — 5.00
Steel, nickel, in bars, 3½% nickel	Lb.	.. — .07
Steel, sheet, Bessemer, 28 gauge	100 Lb.	8.15— 8.50
Tin	Lb.	.. — .60
Zinc, sheets	Lb.	.18— .10

Oils and Coal Tar Products.

Motor Gasoline	Gal.	.. — .32
Motor Gasoline (service stations)	Gal.	.. — .35
Lighting Gasoline	Gal.	.. — .37
Naphtha	Gal.	.. — .31
Coal Oil	Gal.	.. —.20½
Fuel Oil	Gal.	.. — 7.00
Mid. Continent Crude (42 W. gal.)	Bbl.	.. — 2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	.. — 4.25
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	.. — 7.25
Refined Coal Tar	Bbl.	.. — 8.50
Coal Tar Pitch, in Bbls.	Ton	.. —24.00
Benzol, pure	Gal.	.24— .28
Refined Solvent Naphtha	Gal.	.20— .25
Pure Toluol	Gal.	.25— .30
Dip Oil, 20 per cent.	Gal.	.38— .46
Crude Carbolic Acid, 30 per cent.	Gal.	.. — .75
Naphthalin flake	Lb.	.. — .12
Naphthalin Balls	Lb.	.. — .18
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Castor Oil (Commercial), in bbl. lots	Lb.	.30— .32
Cocoanut Oil (Refined)	Lb.	.. — .32
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Linseed Oil, boiled, in bbl. lots	(Imp.) Gal.	.. — 3.28

Gums—

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Indian, No. 1	Lb.	.. — .42
Tragacanth, No. 1, Ribbon	Lb.	.. — 5.00
Tragacanth, No. 1, Flake	Lb.	.. — 4.75
Tragacanth, Turkey	Lb.	.. — 4.25
Arabic, clear amber sorts	Lb.	.. — .21
Arabic, regular grain No. 4 and No. 5	Lb.	.. — .22
Arabic, regular grain No. 2	Lb.	.. —.22½
Arabic, white sorts	Lb.	.. — .40
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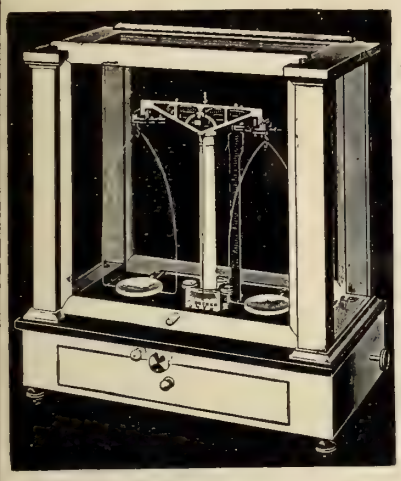

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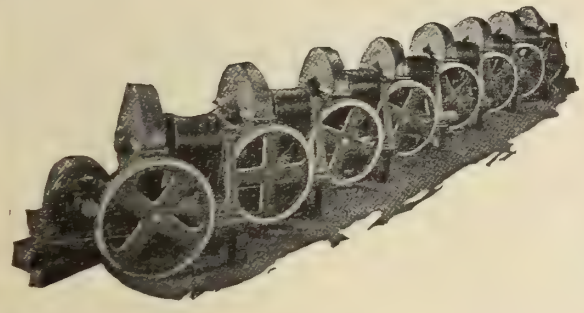

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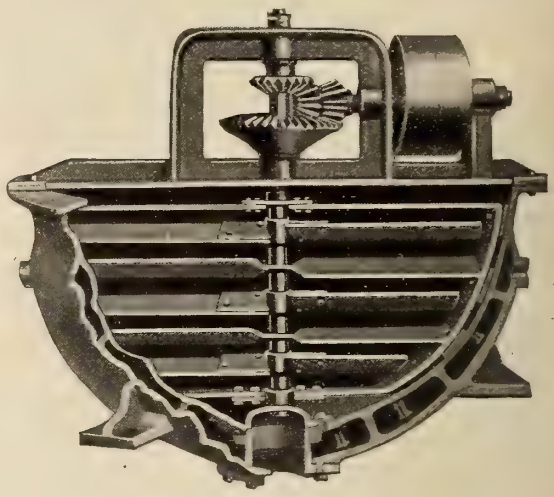

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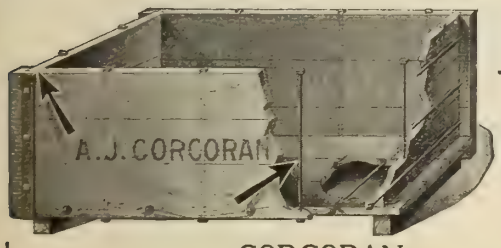

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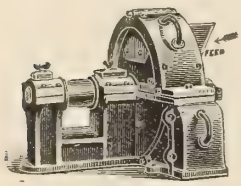

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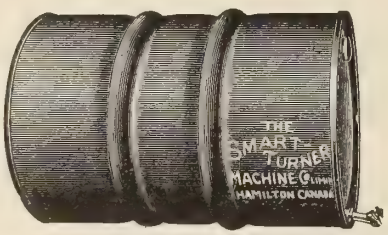

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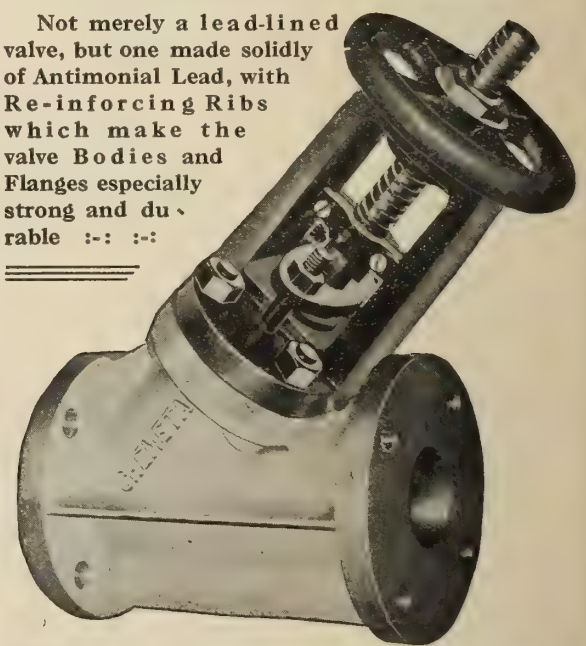

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Electro-Chemistry and Industrial Chemistry.

Vol. III, No. 12 TORONTO, DECEMBER, 1919 25c. a copy.

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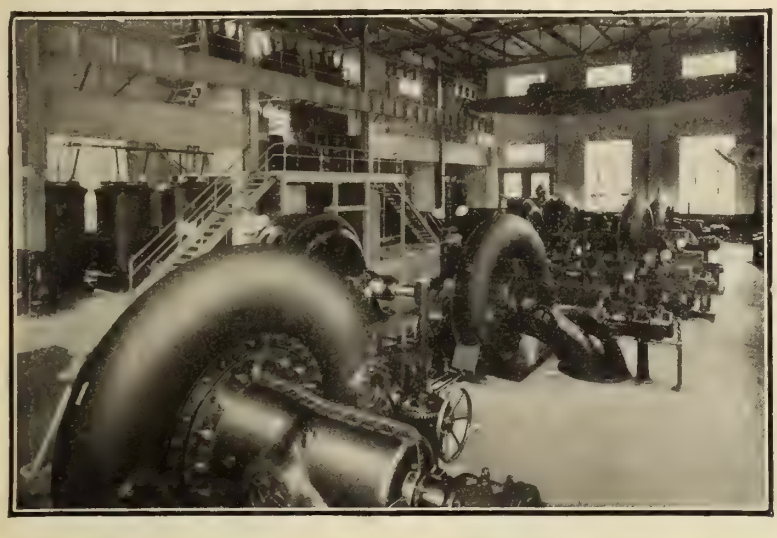
—"Canadian Chemical Journal."

Hydro Electric Power Plants



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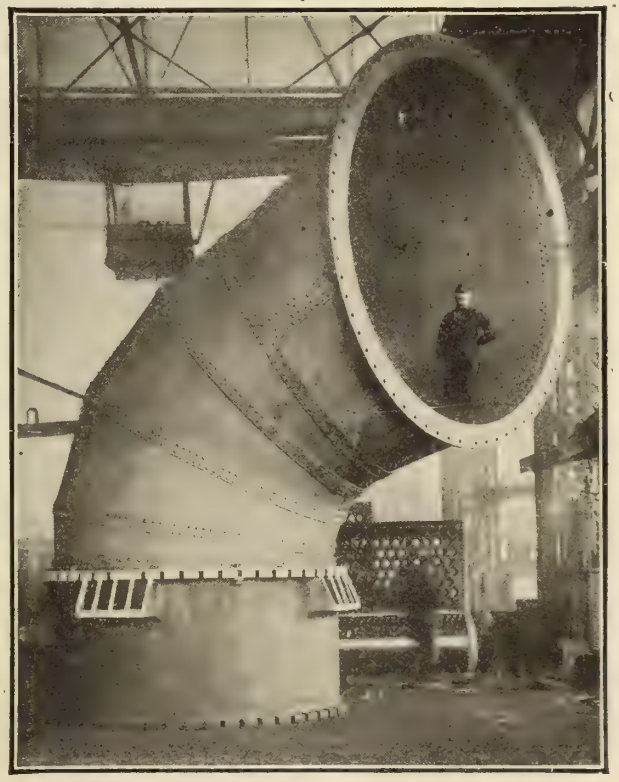

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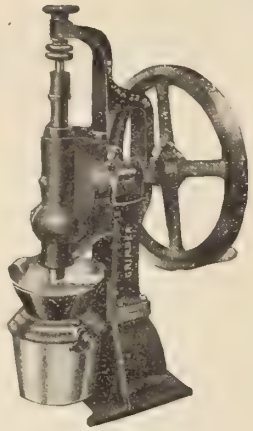
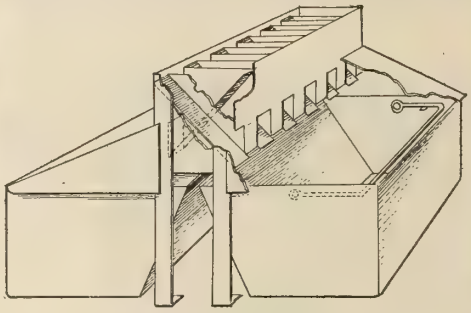
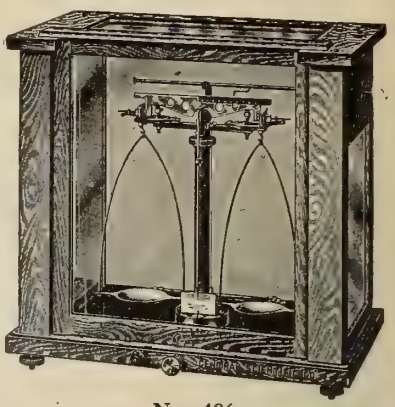


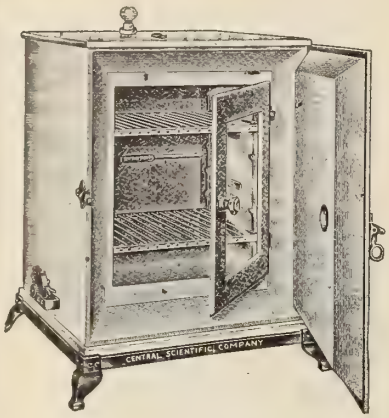
No. 3486
Grind Sample to 60 Mesh



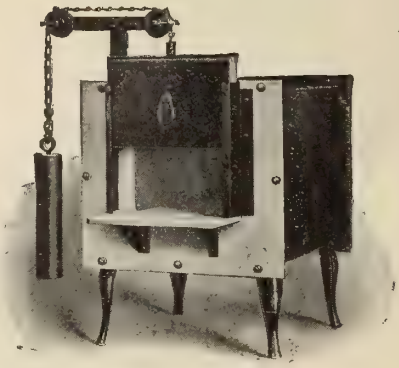
Nos. 11802-4
Reduce Through Riffle Sampler



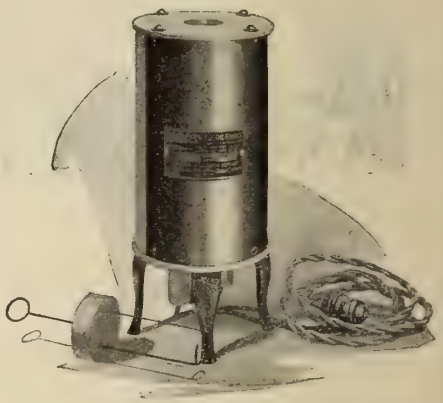
No. 486
Weigh-Out Small Sample



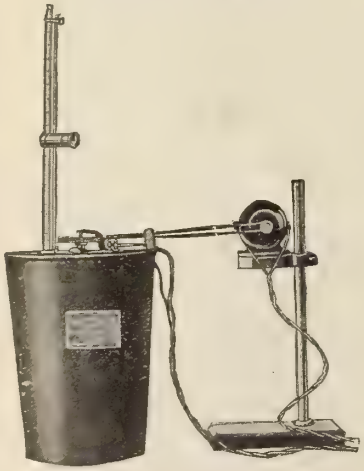
No. 9830
Determine Moisture



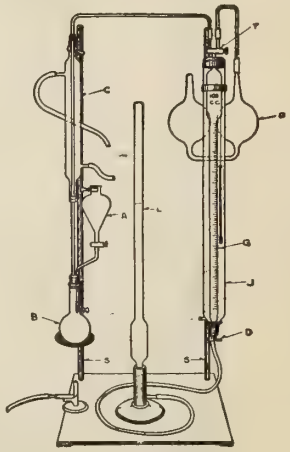
No. 6350
Determine Ash Content



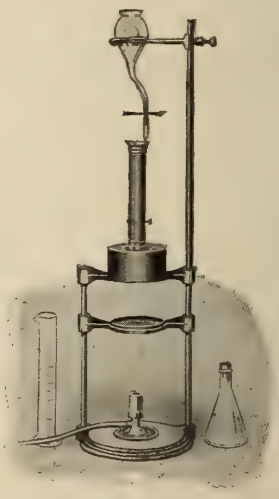
No. 6283
Determine Volatile Matter



No. 2360
Measure B.T.U's



No. 2376
Determine Total Carbon



No. 2378
Measure Sulphur Content

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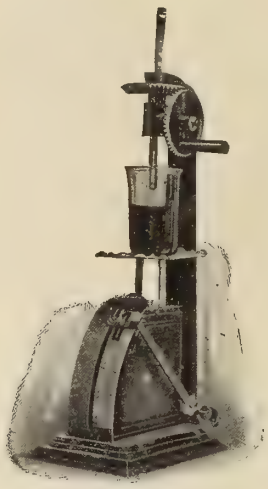

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Above a Dynamometer is suspended a geared sliding spindle, which is pushed down on the sample by revolving the gears.

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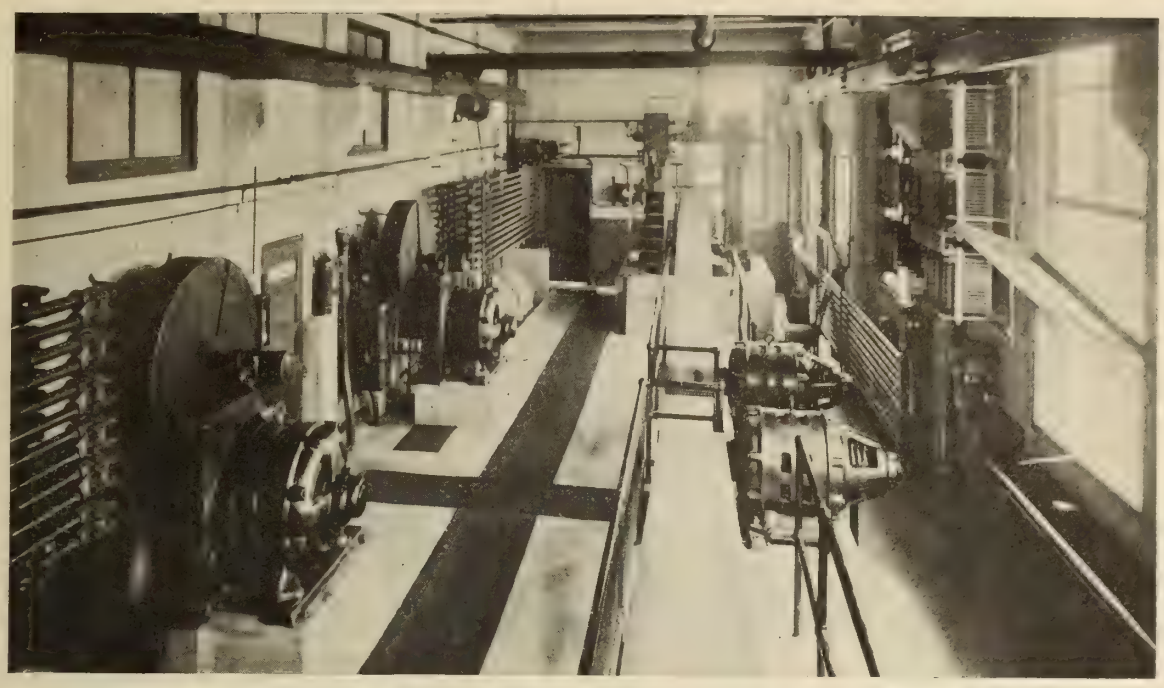

A Niagara Falls Bleaching Gas Plant installation. Two 75-H.P. Westinghouse Motors, at left, geared to line-shafts. Two 50-H.P. Westinghouse Motors, driving ammonia compressors.

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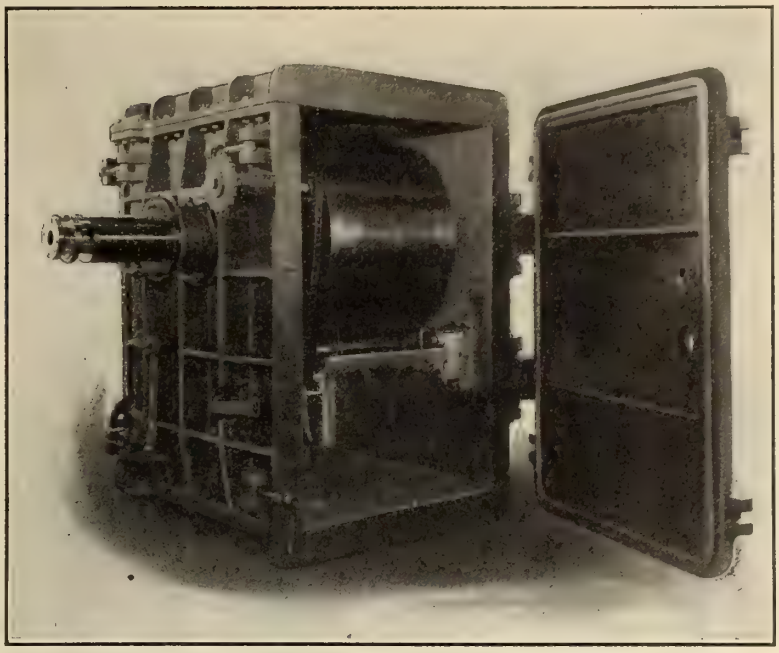
It is no wonder, therefore, that Canada occupied such an important position at the National Chemical Exposition recently held at Chicago, admitted to be the greatest industrial event in the history of that city.

In addition to the large attendance from Chicago, over twenty thousand members of various scientific societies, universities, manufacturing concerns and others interested in commercial and scientific development, attended the Exposition. These included, The American Institute, Mining and Metallurgical Engineers, American Electro-Chemical Society, Technical Association of Pulp and Paper Industry, and others.

The Government of Canada and the Province of Ontario, realizing the importance of this opportunity of telling abroad the story of our resources, were represented by exhibits, and by some of their best men. The Canadian National Railways had an exhibit illustrating the mineral, forest wealth, water powers and raw materials of the country.

During the Exposition two addresses were delivered by C. Price-Green, Commissioner, Industrial & Resources Department, Canadian National Railways, on Canadian National Resources and the great field afforded in Canada for enterprise and investment of capital, which were widely reported in the American press and many scientific publications.



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DEVINE VACUUM DRUM DRYERS are designed for drying to powdered form, all solutions and liquids containing solids.

The Drum Dryer consists of an outer casing of cast-iron and a large steam-heated steel drum which revolves on a horizontal axis in the interior of the casing. The drum dips into the material being handled, which lies in the bottom of the casing, and a thin film adheres to the surface of the drum. In one revolution the material is dried, and scraped from the surface of the drum by an adjustable knife.

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Write for Bulletin 102-A.

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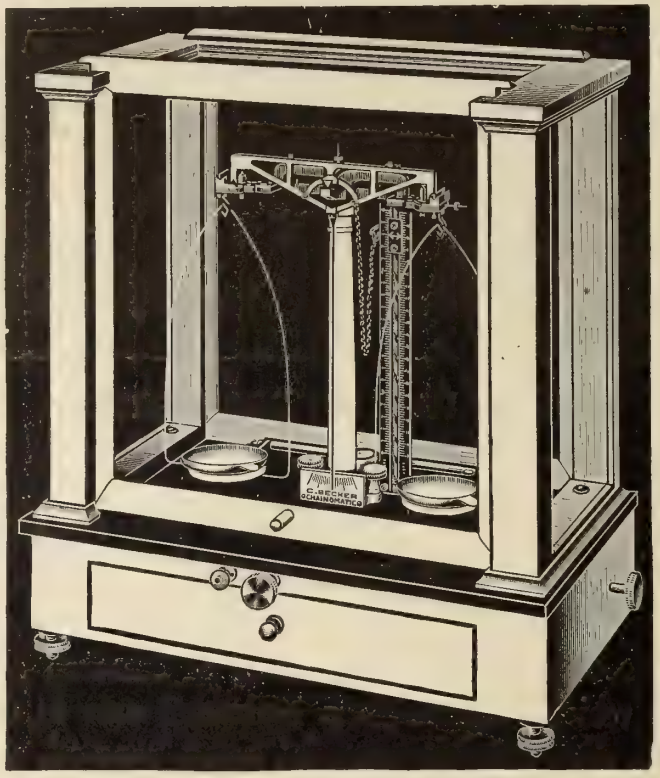

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I, J. A. Dawson, Public Analyst, attached to the staff of the Department of Trade and Commerce, Vancouver, B.C., and acting under the authority of the Adulteration Act, do hereby certify:

(1) That I received from G. C. Crux, of Vancouver, B.C., on the 11th day of August, 1919, a Sample labelled as follows: "Sample of Epsom Salts, from Basque Chemical Production Co., Limited, 509 Richards St., Vancouver, B.C. General average sample of shipment to be made Aug. 12, 1919."

(2) That I duly analysed the said sample and obtained the following results:

Water by loss on ignition	49.12% wt.
Magnesium as Mg	10.29% wt.
Sulphate as SO_4	40.62% wt.
Sodium as Na	0.08% wt.
Silicate as SiO_2	0.01% wt.
Total	100.12% wt.

ARSENIC, LEAD, ALUMINUM, IRON, ZINC, CALCIUM, CARBONATE, PHOSPHATE AND NITRATE. ..... ABSENT.

(3) That the said Sample was:

(a) Of B.P. or U.S.P. purity within the meaning of the Adulteration Act (Section 7), for the following reasons:

It contains not less than 97.4 per cent. of pure Magnesium Sulphate, $Mg\ SO_4, 7H_2O$ (B.P.), also not less than 99.7 per cent., pure Salt (U.S.P.). It is free from arsenic, lead, iron, zinc and chlorides.

(Signed) J. A. DAWSON,
Public Analyst.

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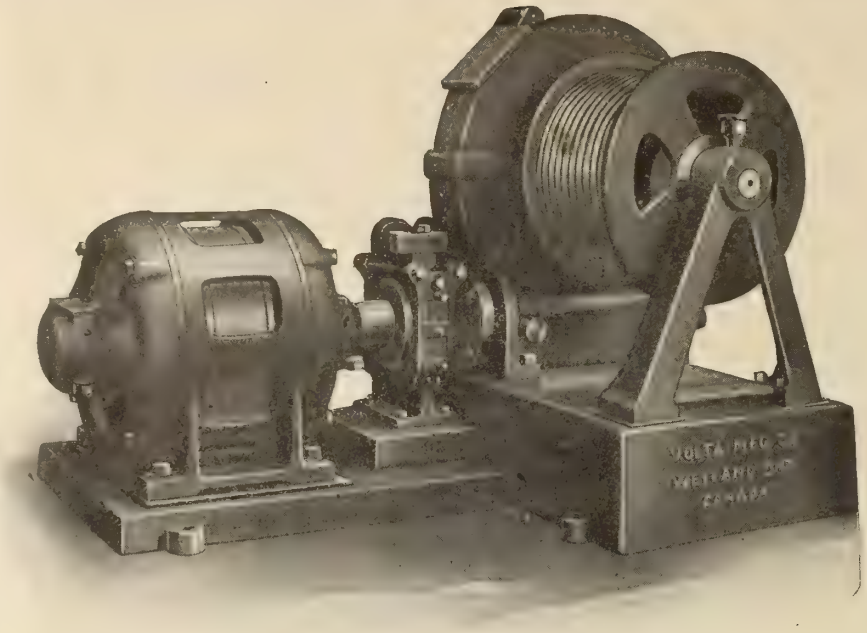

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DEPARTMENT OF LANDS FORESTS & MINES
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G. H. Ferguson, Minister

Apart from the products of the farm, those of the forest and of the mine are of special interest to the chemical and metallurgical industry of America. Ontario's forest and mineral wealth is receiving wide attention and offers great opportunities for the investment of capital.

Forests: Pulpwoods in abundance afford the raw material for the pulp and paper industry. Hardwood is available for the production of wood alcohol and other by-products from wood distillation.

Minerals: In 1918 Ontario produced 45 per cent. of the total mineral output of Canada. Practically all minerals, with the exception of coal and tin, are found in the premier mineral Province of Canada. Statistics of output, as compiled by the Ontario Bureau of Mines, show a valuation of $80,308,972. First among the metallics were nickel, silver, gold and copper. The total value of the chief metals produced in Ontario up to the end of 1918 is as follows:

Silver	$185,027,590	Nickel	$138,010,542
Copper	49,947,080	Pig Iron	78,925,917
Gold	50,864,863	Cobalt	5,918,899

Non-metallic products include actinolite, arsenic, barite, cement, clay and shale for ceramic industries, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, lime, mica, mineral waters, natural gas, petroleum, quartz, salt, sand and gravel, stone for all purposes, and talc.

Industrial Opportunities: Midway between West and East and bordered on the south by the Great Lakes, Ontario occupies a strategic commercial position among the Provinces of Canada. Transportation facilities, both by rail and water, are unexcelled, and present every opportunity for development of the mining, metallurgical and chemical industries. Developed hydro-electric power is available at very low rates from the Hydro-Electric Power Commission of Ontario. Already electro-metallurgical and electro-chemical industries have become established, more particularly in the Niagara peninsula.

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METHYLATED SPIRITS or Denatured Alcohol is sold only by the Department of Inland Revenue, Ottawa, Ont., but any other kind of Alcohol may be secured from us.

Canadian Industrial Alcohol Co., Limited

MONTREAL, QUE.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

THE OFFICIAL JOURNAL OF THE CANADIAN INSTITUTE OF CHEMISTRY

Vol. 3 TORONTO, DECEMBER, 1919 No. 12

L. E. WESTMAN,
Editor and General Manager.

P. F. McCLEARY,
Associate Editor.

T. W. GILLINGS,
Advertising Manager.

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Time of going to press—First of each month. Change of advertisements should be in hand two weeks before.

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Address all communications to The Canadian Chemical Journal, 72 Queen Street West, Toronto, Canada. Telephone, Main 7399.

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EDITORIALS

ECONOMIC STATUS OF THE CANADIAN CHEMIST.

THE Canadian chemist finds himself standing at the dawn of what seems a new era, back of which the dark shades of night cast a pall over all that is past. He finds it hard to foretell what the day may bring, for, professionally, he has had no yesterday, and his stumbling progress during the night has brought little of value for his guidance now that his day has dawned. Lack of opportunity has dwarfed his ambition in some instances; the failure of the people to appreciate his ideas and technical worth has developed a reticence which now often retards his progress. The lack of opportunity has been due, in part at least, to our great wealth of natural resources, for since the first settlers arrived in Canada it has been possible to gain a comfortable livelihood by ordinary industry and without the necessity of much research. Such industries as have grown up have used natural supplies lavishly, and have not been under the necessity of working economically or of finding profitable uses for their by-products. Profits have been good, and it has been always a simpler matter to waste than to work the materials produced incidentally in the course of the manufacture of their main products.

In all this, the chemist has had little place. Progress to him means conservation and development, the unfolding of the bud into the beauty of the flower. But there comes a time in every wasteful nation's life when, be it ever so little, a halt is called in extravagant expenditure; then the chemist has a chance. Thus it is that the older countries of the world have been the leaders in chemical research and scientific progress, and the countries most limited in easily available resources have distinguished themselves among their fellows.

Canada has been no exception among the younger and supposedly progressive nations of the world. Year by year dependence upon the older countries increased; more raw materials were shipped out, and more finished products imported. The war stopped much of our import business, and at first a great wail of distress went up; but that was unproductive of satisfactory conditions, and eventually our people went to work, the virility of the young nation asserted itself and great progress was made.

The chemist emerged. He was given a small job in which he saved the firm money and made things which previously had only been produced in foreign lands. A little of the old-time prestige enjoyed by the chemist returned and the Canadian chemist began to develop confidence in his own ability. He remembered that many, prominent in industrial development in the United States and Europe, were Canadians, graduates of Canadian universities, who, without honor in their own country, had crossed the border to be acclaimed as leaders. One does not have to go farther back than to the name of Robert Kennedy Duncan, that brilliant scholar and magnetic leader, who fathered industrial research in the United States.

So it was that the wasteful process of war in Europe created conditions in Canada favorable to the initiation of national scientific work. Parliament, in response to the nation's appeal, made a humble beginning by appointing the Honorary Advisory Council for Scientific and Industrial Research. The breadth of vision necessary for much advance has, so far, not been characteristic of our law-makers, and the work of the Council has been impeded. Industrially, Canada has made better progress, and today more than ever before, Canadian industries are seeking the assistance of technically trained men, for experience gained during the stress of war has led them to see that money invested in chemical research is likely to return many times over in increased profits derived from better efficiency in their processes, and the utilization of products formerly wasted. Better co-operation between science and industry may be looked for, and while the economic status of the chemist at the present moment is not good, the increased number of opportunities, now being provided by the captains of industry, makes his future assured. The Canadian Institute of Chemistry is welding the chemists together in a chain across Canada which will enable them better to cope with difficult questions involving their professional status; and the various other chemical societies, flourishing, reflect the new interest. Canada is a country of optimists, and optimism is the keynote of research and progress. If the foundations of research are well laid, there need be little fear regarding the superstructure that capital will rear thereon, and the status of the chemist will no longer be a necessary topic for discussion.

CHEMISTRY AND AGRICULTURE.

THIS journal cannot be said to have suddenly become interested in agriculture as a result of recent elections in the Province of Ontario. Agriculture, in general, has been one of the fields that has given the chemist in the past very large opportunities, and agricultural chemistry has for

years been one large branch of the subject. We would point out, however, to those chemists who have found their work in other fields, that the whole of agricultural chemistry does not consist in making analyses of fertilizers. Some of the most complex problems and those most pressing for solution are either directly or indirectly connected with the utilization of soil, the feeding of animals, and the production of crops and food supplies. Like all other branches of chemistry, there are many side lines and much overlapping with other sciences, but on the whole a sound knowledge of the principles of chemical research are essential before much progress can be made in any line or difficulties overcome.

We have developed agricultural schools and experimental farms to a very fair state of efficiency, but it is not unfair to say that the various interests of these organizations has left but little energy for any real attacks on research problems. The perfection of the pure sciences in our agricultural colleges has lost much because they were so closely connected with a student body for the most part interested in what seemed to be more practical things, and also for the reason that no close connection was maintained with universities where more of the academic or research spirit might be imbued. Engineering has contributed to agriculture, practical farmers have been given better methods, better stock, and a keener ambition to develop the soil possibilities, and on the whole, progress has been wonderful. Now, in order that it may be sustained, our facilities for the application and spread of general agricultural science must be increased, and above all, more attention and more suitably trained Canadian minds should be directed towards the solution of basic problems, and the development of the new in agricultural science. Most of the keenest weapons of attack will more than likely be found to be chemical.

CROWDING OUR CHEMISTRY COURSES.

NEVER before in the history of Canadian universities were courses in chemistry and chemical engineering so filled with students as they are this year. Reports from various universities show that facilities are being taxed to their limit to allow for the laboratory work of junior students. The same condition holds for courses in metallurgy. At the University of Manitoba, a new temporary building is being constructed on the campus, to relieve the congestion in all departments of science, and, in the meantime, both staff and students are working under most trying conditions.

At Toronto, Queen's and McGill, the pressure is equally great, and accommodation and staffs must be increased before these students can be carried on to their senior years and given suitable opportunities for extensive experimental work during their undergraduate period. When the necessary facilities are considered for greatly expanding the amount of post-graduate work, the present conditions are quite inadequate.

During the war there was a popular epidemic or wave of public regard for the work of the chemist. He became known as a necessity, a key-man, and individuals with a very limited previous knowledge of industrial chemistry were called upon to control and direct the manufacture of chemicals which were most important from the war standpoint. When the war broke out, Canada needed chemists, and our universities united could only supply a very few. Now, when that crisis has passed, we find, as a natural secondary result, crowded classes in chemistry at all our universities. A second cause has been the repeated statements made that we had so few men in Canada capable of doing research work. This appeal has evidently been heard by those who direct students, and we find a young and ambitious army starting on the way that leads to this goal. The professional chemist also seems now to be able to obtain a proportionately larger financial return for his services than hitherto, and while he has not yet quite caught up with other professions, he has made some progress recently.

No matter if the causes have not been completely covered, the fact remains that there is, this year, an unprecedented number of students in science courses. There are a few who would solve these problems by the simple method of discouraging students from entering courses in chemistry. At first sight, one would feel like brushing aside such a course as utterly foolish, and not to be considered, were it not for the fact that some who take this view are men of rank in their profession.

In the past, Canadian chemists have found their best road to success in many instances in the United States, but we cannot, and should not, expect our men to look always in that direction. The universities of the United States are also swelling the numbers of young graduates at a most rapid rate. Trained chemists are not a profitable class to export from any country, much less from Canada, where our whole industrial expansion depends on their control and research.

There is a solution, however, which can be brought about if taken up seriously. There are still many plants and companies in Canada that might well introduce chemists into their organizations, and that have not done so. Manufacturers in all lines should be approached directly with a view of expanding the field of operations for chemists. The Research Council could help and the Institute of Chemistry, along with the Society of Chemical Industry, should take up the serious business of creating suitable openings for more chemists in this Dominion, as they

come from the universities. If this country only had backbone enough to pay recent graduates a living wage, the studentship and fellowship idea of the Advisory Research Council might prove of practical use. We would suggest that the amounts stipulated as salaries be doubled, and that more serious management and direction of the work done be undertaken. Propaganda of the kind that makes a Victory Loan successful should be started, with associations of manufacturers and our leading industries. These men who are receiving courses in science, and in particular chemistry, should be our most adjustable men in industry, and they are. The outlook from any business profession must be broadened, if obtained from the angle of approach taught by science.

Unless some action is taken, the fears of disappointment may be realized by some now entering special courses in chemistry at our universities, but the blame will rest on the shoulders of a system of business and industry that has not learned the real sources of its power. We are continually facing opportunities, and our universities have one now in their hands. If we were industrially awake in this country, we could absorb more chemists in the fields of agriculture, wood products, mining and manufacturing, and in all our various industries, than we are likely to find coming forward, but if we go along, doing nothing about it, it is quite within reason that disappointment may arise and that the profession in the Dominion may be heading for a bump which it will not be pleasant to receive.

The good work that chemists could do is increasing rapidly; men are offering themselves, but our industrial machinery is not opening the doors to the fields of labor with sufficient rapidity, faith and enthusiasm. It is no longer up to the chemist, but it is now the duty of the business world to become acquainted with the chemist. Let the introductions be mutual and immediate.

LEAVING GOVERNMENT EMPLOY.

THE Government Laboratories at Ottawa are feeling the competition of Canadian industries for chemists, and the work of several of the branches has been badly hampered, and in some cases well nigh disorganized by the continued depletion of their staffs, caused by the various Canadian industries offering substantial financial inducements to the men who have been doing good work in these laboratories. Recently we have noted in this Journal the passing of many chemists from the employ of the Government to industrial work.

The reclassification of the Civil Service, particularly as it affects the Chemical Branches, is meeting with the hearty disapproval of the chemists and all those interested in the elevation of the status of the profession of Chemistry in Canada. Chemists now in the Government service have to make sacrifices which the Canadian people have no right to expect from their servants, and unless some constructive action is taken soon the entire chemical service of the various Government Departments will be reduced to such small numbers that efficient service will be an impossibility.

THE DAILY PRESS AND SCIENTIFIC INFORMATION.

ACCORDING to an article in the daily press, a "graphite deposit" has been located in Northern Manitoba. This is, indeed, decidedly interesting information. Unfortunately, it lacks a feature, which, outside of pure fiction, is necessary; and above all in scientific reports is insisted upon, namely, truth. Mr. E. L. Bruce, of the Geological Survey of the Department of Mines, Ottawa, recently made a survey of the district in which the "deposit" of graphite is said to have been found, and, although his report consists of 78 pages of detailed information concerning this territory, he makes no reference to a deposit of graphite. A black carbonaceous slate is described by Mr. Bruce, but he observed no deposits of graphite. And yet, a western daily reports that a certain gentleman had been showing "some more interesting graphitic schist" from that district, and continues further on to say that "this is a huge deposit. Where the body was trenched, it measured 195 feet from wall to wall." But it remained for an Eastern Canada daily to plunge in a little further into the caldron of misinformation, and we find some good puritanical easterner, in the columns of a staid family journal, leaving his reckless western contemporary far in the rear, for we read in the latter's report the heading, "Government Geologist Reports," and the sentence, "One occurrence was reported on the shore of Beaver Lake, which was examined by Dominion Government geologists." Now, one would naturally conclude that this deposit was surely a real, genuine, honest deposit, since it had been "examined by Dominion Government geologists," but, on closer examination of the above-quoted sentence, one sees that it might be either the "occurrence" or the "lake" which had been examined by Ottawa surveyors. If the latter was meant, it is true, although, as we have been informed by the director of the Geological Survey, Ottawa, no deposits of graphite in Northern Manitoba are known to their surveyors, but if the occurrence was referred to, it is not true, and the sentence, as is the whole article, is misleading.

Now the point is this, that daily papers can do an immense amount of good work, and give a real service to science by publishing reports as to the development of our resources, but they should be statements of fact and not dreams of some promoter, who

gives his information to the press because he has an unweighable article for sale, namely, stock.

We mention the graphite deposit only because it is one of the many such newspaper reports that have come to our notice lately as being absolutely incorrect and misleading. Daily papers are, of course, not responsible for articles of such a nature, in the same way that scientific journals or journals covering certain fields of development are. A metallurgical, chemical, or any other such publication of any standing whatever, gives its readers only information that is either stamped with the author's name, or has been gleaned from scientific societies' or official reports of some kind.

If the daily press is going to feature industrial and scientific reports, all well and good, but unless they too measure and weigh their reports with the same standards that scientific journals do it will not be long before even the general public (the man of science has long since) will become thoroughly immune to such reports and take them at their salted value.

SCHOOL OF ENGINEERING RESEARCH.

ON previous occasions it has been a pleasure to note the rapid progress being made by the relatively new School of Engineering Research connected with the Faculty of Applied Science and Engineering of the University of Toronto. This new organization has just recently published its first bulletin containing the results of research work carried to completion during the last two years. Much credit is due Dr. W. H. Ellis, and Dr. M. C. Boswell, the secretary, for the progress that has been made. The cause of Applied Science in Canada owes much to the former head of the Department of Chemistry and Dean of the Faculty.

In 1917 this new work was inaugurated at the suggestion of Dr. Ellis, and is being carried forward by a notable group of professors connected with the university. Researches are selected by a committee of management, consisting of fifteen members of the Faculty Council. There are two general ideas connected with the work. The primary aim is the training of men in research methods, and the second object is the carrying out of useful research within the school itself. The principle is taken that any organization of research as applied to industry in Canada is very deficient, which does not adequately recognize the necessity for developing primarily the whole of the research activities, both pure and applied, in the leading universities of the country.

When one considers that this group of men has undertaken and carried out some fourteen various researches of considerable length and magnitude at an expenditure of only four thousand dollars, which may be charged directly to this work, the results are really remarkable. The toning influence on the science departments of the university must be valued at much more than this amount. The beginning has been modest, but we believe very sound in principle, and while these men have demonstrated economy in their work, adequate support for scientific research in Canadian universities must be forthcoming just so soon as the governments, Dominion or otherwise, come to realize that research of this nature places an instrument of incalculable power in the hands of any nation which efficiently, but at the same time sanely, organizes and develops it. Modern industrial progress is inseparable from the application of scientific laws and principles to materials.

We need men of vision, keen minds, who will discover and apply the laws governing the relationship of materials, and above all a greater appreciation of such work on the part of the average citizen and business man.

THE RETURN OF THE OIL SEEKERS.

THE past summer has seen some real prospecting for oil in Alberta. A beginning of a very large program of development has been made, and now the first opportunity is at hand for a review of the field observations and such drilling operations as have been carried on. Nothing spectacular has been found, or at least has not been made public. The whole world and all the interests involved, both private and public, have had their representatives observing the work as closely as possible. After the survey parties have reported, work and drilling operations will be carried on next year. Very large possibilities are confidently expected, and whether strikes of world-wide importance or not are made as a result of surveys to date, the general Alberta oil fields, more particularly those in the north, are going to receive an exhaustive examination before a final decision is arrived at regarding their producing possibilities.

OIL SHALES IN ENGLAND.

The discovery of large deposits of shale oil in the King's Lynn district, Norfolk, England, is likely to prove of considerable benefit in view of the increased cost of coal production. The deposit discovered has been estimated by Dr. W. Forbes Leslie, an expert geologist, at 2,000,000,000 tons of shale, while the content is said to average 50 gallons of oil per ton. Dr. Leslie believes that the supply is practically inexhaustible, and is not injured by sulphur.

FUEL CONTROLLERS CONFER.

Mr. C. A. Magrath, Fuel Controller for Canada, during the past month, paid a visit to Washington, where he conferred with Dr. Garfield, United States Fuel Controller, with the object of having Canada's fuel requirements filled as adequately as the situation in the United States will permit this coming winter.

Determination of Arsenic in Organic Compounds Such as Salvarsan

By L. JOSLYN ROGERS

The attention of the writer was drawn to the determination of arsenic in organic combination when requested to devise a suitable method for use in factory control. A study of the problem soon revealed that the difficulty lay in the decomposition of the organic matter without loss of arsenic. It was found that in the sodium peroxide fusion a smell of arsenic was always evolved. The Johnson and Chittenden, as well as the Fresenius and Babo methods, failed to destroy the organic matter at all suitably.

A very rapid and complete decomposition method was finally evolved by employing ammonium persulfate in nitric acid solution. (This was suggested by the well-known method of decomposing the dimethylglyoxime precipitate of nickel previous to cyanide titration). By this method one-half gram can be decomposed to water white color in 15 to 20 minutes.

The analysis is conducted as follows: One-half gram of compound is transferred to a 500 cc. erlenmeyer and dissolved in 10 cc. of water; 5 cc. of nitric acid is then added. The solution is gently heated on a hot plate and ammonium persulfate added in lumps until the solution is water white. If the decomposition is extremely difficult and a yellow color persists, add a few cc. of water and several grams of persulfate all at once. This will usually clear the solution as soon as boiled a few minutes. The volume is made up to 100 cc. and 5 cc. of saturated microcosmic salt solution added. Magnesia mixture is added in excess, about 40 cc., if a precipitate forms dissolve in dilute nitric. Maintain at near boiling and add decided excess of ammonia in the usual manner.

This gives a mixed precipitate of the phosphate and arsenate of ammonium and magnesium. This co-precipitation was first employed by J. C. Berntrop[1], and has the advantage over many other methods of precipitating arsenic in that it is very complete.

The above mixed precipitate is cooled, allowed to stand about two hours, filtered and washed with dilute ammonia, and treated by the usual potassium iodide reduction method followed by titration with thiosulfate. Details are as follows: The precipitate is sucked as dry as possible on the filter and both precipitate and filter returned to the precipitation flask. This latter usually contains considerable of the precipitate on its sides. If the flask is carefully washed out at the time of making the filtration, these adhering particles need not be detached. 70 cc. of dilute hydrochloric (three of acid to two of water) are added and shaken about till solution is effected. Cool and add three grams of potassium iodide in 6 cc. water, rotating one minute. Then add 70 cc. water and titrate at once with thiosulfate. Use starch when near the end point. Shake well at finish to bring all the iodine out of the filter paper.

This method has merit, the writer believes, over the Lehmann[2] procedure, which has been adopted in some countries as a standard method for Governmental inspection of such drugs as salvarsan. The Lehmann method employs but 0.2 grams substance, and decomposition is effected by means of potassium permanganate in sulphuric acid. The use of so small a sample on an analysis which has a relatively high blank very seriously affects the accuracy of determinations. The decomposition of the excess of permanganate or manganese dioxide by hydrogen peroxide is an operation which must be conducted with a great deal of care and which cannot be left to an inexperienced operator.

Another factor which ought to receive thorough consideration is the standardizing of the thiosulfate solution, and the calculation of the correct factor. This is most suitably done by preparing an N/10 arsenite solution and taking 20 cc. for one test and 40 cc. for the second. The true blank in this case can be determined by multiplying the titration on the 20 cc. test by two and subtracting from it the titration on the 40 cc. test. Stock reagents should be used in all blanks and analyses, and whenever a new bottle of any material is introduced the blank should be carefully redetermined.

The writer has been applying the co-precipitation method for arsenic to a variety of materials since Smith[3] published his article and finds that rather a large field of rapid and accurate applications of this method has been opened up. Articles on these subjects are in preparation.

University of Toronto, Department of Chemistry.

Toronto, Nov. 17, 1919.

[1] J. C. Berntrop Zeit. fur Anal. Chem. **41** p. 11, (1902).
[2] Apoth. Ztg. 27, 545-6.
[3] Smith, Circ. 102 Bureau of Chemistry, Washington, D.C.

COMMERCIAL FIXATION REPORTED SOLVED.

That Germany had solved the problem of the fixation of atmospheric nitrogen as a commercial undertaking on a large scale, and that in future, from the point of agricultural fertilizers, she would be independent of any blockade, was the statement made by Dr. Edward C. Worden, chief chemist on explosives of the United States Bureau of Aircraft Production, Washington, on his return to England, a short time ago, from an inspection of the chemical industries of Germany. The headquarters of the industry for nitrogen fixation, Dr. Worden reported, was at the Haber plant of the Badische Anilin and Soda Fabric, at Oppan, near Ludwigshefen, on the Rhine, to which the German Government, since the signing of the Armistice, had loaned nearly 200,000,000 marks. Begun since the Armistice, built with reinforced concrete, this factory has now between 8,000 and 9,000 actively employed. When complete it will have a storage capacity of 350,000 tons of ammonium ready to be turned into ammonium salts and a daily capacity of 2,800 tons, an amount sufficient with potash and phosphates, to give an abundance of fertilizers for all German agricultural purposes.

"Speaking generally," said Dr. Worden, "the chemical industry of Germany is, and has been since the Armistice, just as prepared for peace operations as though war had never interfered with it. The technical staffs of the great concerns are at their maximum numbers. The skilled workers seem as numerous as ever. If these men were engaged on war work it was either as clerical workers or as assistants of Government undertakings. They certainly never saw the trenches. The dye and pharmaceutical industries are in as strong a position as ever, if not stronger."

Natural Sources of Magnesium, Sodium and Potassium Salts, Located at Dana, Saskatchewan

A General Description of Deposits, their Possible Origin and an Outline of the Methods Used in Preparing Pure Salts from Natural Mixtures

By C. W. HANCOCK

General Description.

About three miles north of the village of Dana, Saskatchewan, and three-quarters of a mile west of Maskakee Springs siding, on the Prince Albert branch of the Grand Trunk Pacific, is situated a lake known as Muskiki or Houghton Lake. This lake is surrounded by a slightly elevated and rolling country, and extends to the north and west, covering an area of approximately eight square miles. The lake is divided into three sections, the Upper or Northern, the Central or Eastern, and the Lower or Southern section. The upper and Central parts are connected by a narrow channel called the Narrows, while the Central and Lower parts are joined by two narrow channels forming a small island. The Southern section is very shallow, being covered with water averaging three inches in depth. The Central section, covering an area of nearly two and one-half square miles, is covered with water to the extent of twelve inches in depth, and the deposit of salt directly underlying the water varies in thickness of from six to twelve inches. In this section, in the vicinity of the island, the springs which feed the lake occur. The Northern section, the largest of all three, covering an area of three and one-quarter square miles, water ranging on an average of twelve inches deep, and the salt deposit underlying the water having a mean thickness of twelve inches. Immediately beneath the entire salt deposit is a bed of slimy black mud of a depth of from three to five feet, laden with salt crystals and containing a fairly high percentage of organic substances. Underlying the bed of mud a second layer of salt has been located, which varies in thickness from twenty-four inches to four and five feet, and of the same general shape as the upper layer. The second layer of salt has not been investigated to any extent, and of the substances below this second layer nothing is known at present. The amount of Sodium Sulphate calculated as Glauber salt contained in the upper layer alone is calculated at three million tons. Analysis of upper layer of salt deposit is as follows:*

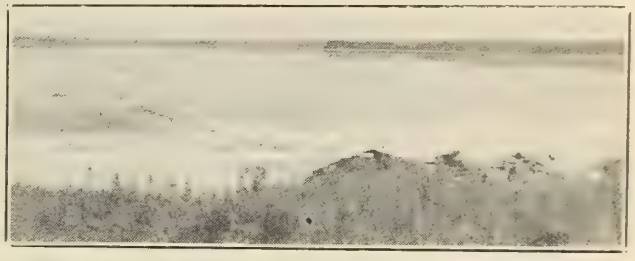
Insoluble matter	0.34
Alumina	0.27
Fe_2O_3	none
$CaSO_4$	0.49
$MgSO_4$ anh.	4.23
NaCl	0.39
NaBr	0.21
$NaSO_4$ anh.	54.59
Water of Crystallization	39.48
	100.00

The lake, as stated above, is constantly fed by underground springs located in the Central section. There are at least nine main springs and numerous smaller ones. These springs, during their travels through the earth at lower levels, have evidently passed through beds of salt, as the water which flows into the lake contains a high percentage of the various salts in solution. The salt content of the spring water varies considerably, depending on the time of year. The specific gravity of this water reached the point 1.3463 at 21° C. last August, while in the cold weather it generally runs at 1.1215. The temperature of the spring water corresponds very nearly with that of the prevailing temperature of the lake water, generally slightly warmer. The following analysis will demonstrate the comparative values of the salts contained in solution:—

Specific Gravity at 18° C.	1.1215
Total solids at 105° C.	16.9472
Solids after ignition	12.5962
Loss on ignition	4.351
Calcium Oxide	Trace only
Magnesium Oxide	4.025
Potassium Oxide	.1525
Sodium Oxide	1.016
Silica	.008
SO_3	7.712
Cl	1.79
CO_2	.0841

Results expressed in grams per 100 cc.

The lake water is comparatively the same composition as that of the springs, with the exception that it is of



Muskiki Lake, showing Salt Deposits.

higher specific gravity, due to the natural process of evaporation throughout the year. Analysis is as follows:—

Specific Gravity at 18° C.	1.190
Total solids at 105° C.	27.661
Solids after ignition	20.981
Loss on ignition	6.680
Calcium Oxide	Trace only
Magnesium Oxide	6.351
Potassium Oxide	.292
Sodium Oxide	1.760
Silica	.008
SO_3	11.66
Cl	3.580
CO_2	.114

Results expressed in grams per 100 cc.

The calculated amounts of the different salts contained in the lake water are approximately as follows:—

Magnesium Sulphate (Epsom Salts)	2,000,000 tons
Sodium Sulphate (Glauber Salt)	600,000 "
Potassium (calculated as Potassium Chloride)	3,000 "

Incidentally, one might add that the supply of lake water remains constant and consequently this source of salt supply is not effected by reasonable withdrawal of water for evaporation and extraction of the various salts.

Origin of Saline Deposits.

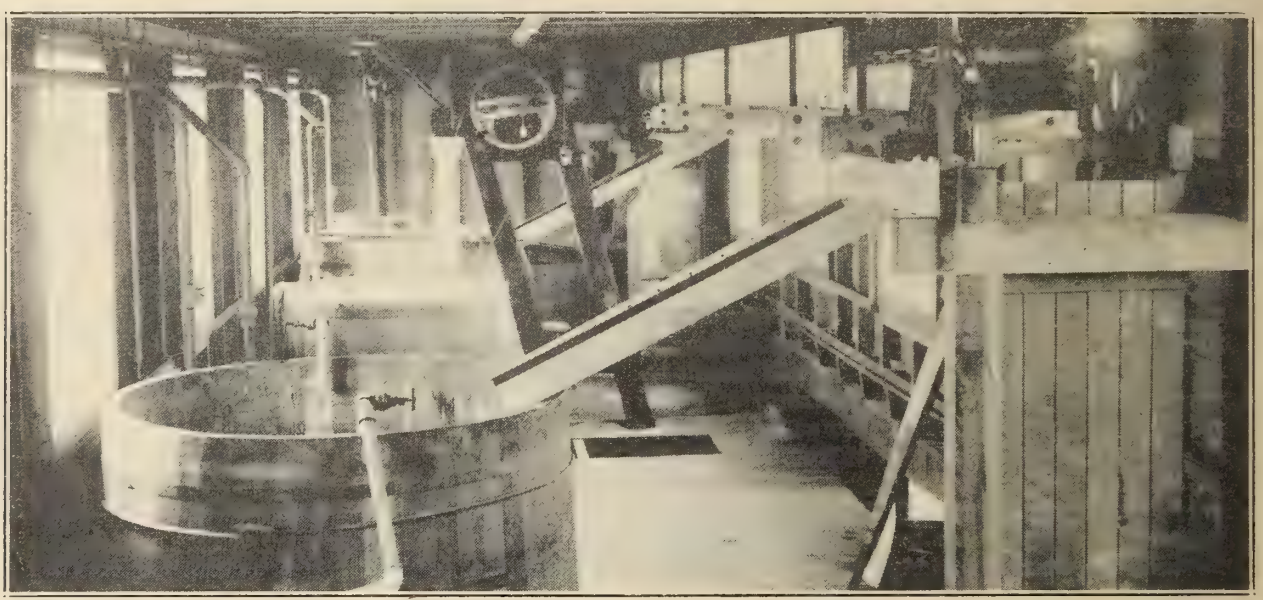
Several theories have been brought forward regarding the process and the condition under which the alternate layers of salt and mud were deposited. The writer is much in-

*Analysis by Stillwell & Gladding, New York, 1917.

debted to Dr. Otto Klotz,* who has given a possible explanation from a geological standpoint. He writes as follows:

"Lake Agassiz belongs to the Quarternary period in America, and is fairly well marked by its sediments and shore lines. It occupied the basin of the Red River and Lake Winnipeg, projecting into Minnesota some one hundred and fifty miles, and extended along the Saskatchewan and South Fork past Saskatoon to the Elbow. In area at its maximum it exceeded that of the combined Great Lakes and covered about 110,000 square miles, while the latter covers about 95,000 square miles. Lake Agassiz is intimately connected with the glaciation of the north-western part of America, including the whole of Canada.

The presence of a layer of earth between saline deposits of Muskiki Lake may be attributed to the different stages of water level, the waters being alternately very saline, almost fresh, and with the recession of Lake Agassiz again very saline, as the latter is due to the springs by which it is fed, and which bring the saline matter in solution from lower levels, that is, from the crust of the earth."



View of Equipment for Treating Crude Salts at Kitchener plant.

Process of Development.

In the year 1914 a company known as the Salts & Potash Co. of Canada, Limited, was formed for the purpose of development of these natural resources on a large scale, and up to the beginning of the present year much valuable scientific data was accumulated, and many of the foremost chemists of United States and Canada were consulted regarding the working possibility of the project. No definite steps were taken, however, to determine by experiment economical methods of extracting and refining the various salts. In February experimental work was begun in a laboratory created at Kitchener, and methods were formulated by which the two main products of the lake water and salt deposit could be separated economically. A small experimental plant was next rigged up and the results in the laboratory verified by producing refined products on a comparatively large scale. Plans were then proposed for the erection of two plants, one plant at the lake for evaporating the lake water, with the necessary equipment for the excavation of the salt deposit, the other plant to be erected at Kitchener, Ontario, for refining purposes.

Evaporating Plant.

The equipment used for evaporating the lake water at the lake plant is that of the "Shaw System." This system consists of a battery of "Jolt tubes" set in parallel through which the brine is circulated by means of a Rees Roturbo pump at a rate of 600 gallons per minute through a centre channel of the jolt tube under a pressure of 100 lbs. per square inch, while high pressure steam is passed the opposite direction through two channels separated from the centre one by corrugated copper. The system is highly efficient, due to the high velocity of the liquors and the consequent scouring effect of the copper tubes producing a high coefficient of heat conduction. The liquors, on leaving the "Jolt tubes," are led to a "Separator" or Explosion chamber, where the pressure is relieved, the exploded steam separated, used as a preheater for the incoming brine, and the concentrated liquors being continuously circulated until the concentrated point has been reached. It is then diverted through a cooler and is ready as crude dry salt for shipment to the refining plant at Kitchener.

Refinement of Crude Salts.

The plant designed for this purpose consists of three distinct processes:

(a) The separation of Sodium Sulphate from the crude salt cake giving certain by-products such as Magnesium Carbonate.

(b) The separation of Magnesium Sulphate from the crude salt obtained by evaporating the lake water, with the production of the by-product, Sodium Sulphate.

(c) The treatment of the accumulated mother liquors from (b) and (a) obtaining such salts of Potassium as the Chloride, Sulphate, and Nitrate. Sodium Chloride as a by-product.

The refining plant at Kitchener (just completed) is equipped with all modern apparatus, consisting of: Steam dissolving vessels, labor-saving conveying apparatus, centrifugal wringers, drying ovens, etc. The plant will have a capacity of one hundred to one hundred and fifty tons

*Chief Astronomer of the Dominion Government, Ottawa.

of refined salts per week for the first six months. U. S. P. and technical grades of Epsom and Glauber's salts will be produced. Analysis of the first batch of Glauber's salt produced on a large scale is as follows:

Insoluble matter, chiefly Mag. Carbonate	0.1%
Sodium Chloride	0.162%
Mag. Sulphate	Trace
Sodium Carbonate	Trace
Calcium	Nil
Sodium Sulphate (Glauber's Salt)	99.73%

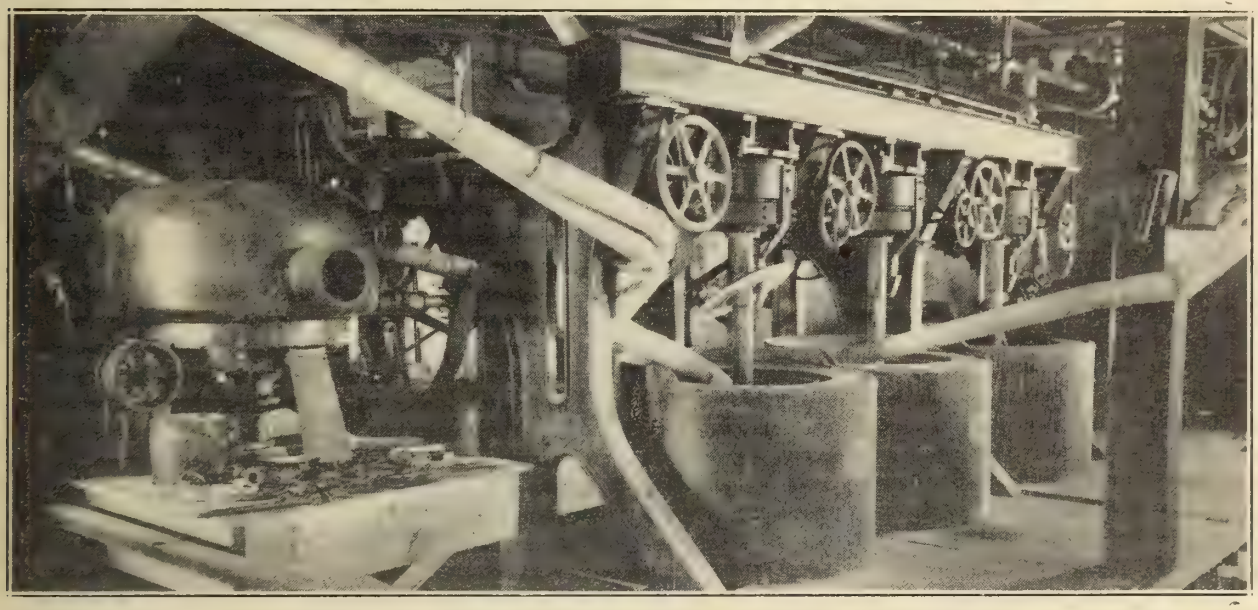
The Magnesium Carbonate produced is very light and of high purity. Analysis was not completed at time of writing.

Special attention has been given to the production of Potassium salts for agricultural purposes. Also medicinal salts of high purity will be prepared.

Market Control.

Up to the time of the Great War, Germany had controlled the markets of this country in Glauber's and Epsom Salts, and especially that of Potassium Salts. The war has demonstrated beyond doubt that there is as much enterprise in the average Canadian, if not more so, than in one of any other nationality, and furthermore, it has opened the eyes of the people of Canada as to the wealth of her natural resources undeveloped. The project as described above is undoubtedly a national undertaking, inasmuch as it means a beginning of the development of Canada's natural resources of salt deposits. The parties interested in the development of this undertaking are working in a thorough, pains-taking manner, and have not hesitated to expend large amounts of money in order to attain the required results. The products which will shortly be placed on the market will be of highest purity, and manufactured at a cost which will invite keen competition with foreign producers for either medicinal or industrial consumption.

Kitchener, Ontario, November 1, 1919.



Battery of Centrifugal Wringers in operation at plant of Salts and Potash Company, Kitchener, Ont.

ELECTRIFICATION OF RAILROADS.

Mr. Paul M. Lincoln, past President of the American Institute of Electrical Engineers recently addressed the Electric Club of Toronto upon "Railroad Electrification," and gave many interesting points on this ever interesting and important subject. Through his connections with the General Electric Company of the United States and his commission to report upon the electrification of the Acheson, Topeka, and Sante Fe Railroad, Mr. Lincoln was in a very able position to treat his subject with some authority.

"In the United States the railroads use 150,000,000 tons of coal, or twenty-five per cent, of all the coal mines. Further, ten per cent. of their efforts are directed in hauling this fuel," said Mr. Lincoln, to show the significance of electrification. Other statistics showed that six pounds of coal were required to develop one horse-power per hour in each locomotive. By the use of electric power this could be reduced fifty per cent., and possibly the same service rendered by a reduction in the coal bill of 100,000,000 tons.

"Every element of railroad electrification has been solved. There is nothing experimental in pressing the claim for electrification," said Mr. Lincoln. "It has been started and a considerable amount of work has been done. As an engineering problem it is solved. But we must do more and make it an economic success. The dollars spent must be shown to have been spent wisely. That has already been the case, and it is the entering wedge."

RECOVERING UNOXIDIZED SULPHUR DIOXIDE.

According to British Patent 132,661, British Dyes, Ltd., have discovered a simple method for recovering unoxidized sulphur dioxide during contact manufacture of sulphuric acid. The process consists in washing the gases as they pass to the scrubbers with a solution of sodium sulphite, and then heating the resulting solution discharged from the scrubbers with sulphuric or hydrochloric acid which may be weak acid products containing sulphuric acid, such as nitre cake. The solution should be heated by a closed steam coil and agitated to effect liberation of the sulphur dioxide which is finally dried and led to contact chambers.—*The Dyer and Calico Printer, London, Eng.*

PLATINUM*

Properties, Natural Occurrences, Analytical Tests Possible in the Field, Metallurgy and and Geological Formations Usually Present Where this Metal is Found

The following statement regarding platinum is issued in response to numerous inquiries. In preparing it a number of authorities have been consulted, the publications of James M. Hill, of the United States Geological Survey, having been especially drawn upon.

Platinum is a white metal with a grayish tinge, and takes a high polish, but one less brilliant than silver. It is very malleable and ductile, and can be rolled into thin sheets and drawn into fine wire. These properties are impaired by the presence of impurities. It has a specific gravity of 21.3 and a hardness of 4 to 5 being harder than copper, silver, or gold. It melts at about 1710 degrees C. The atomic weight is 195.2.

Platinum is not acted on by dry or moist air, even when heated to high temperature. It is not attached by hydrochloric, nitric, or sulphuric acid, but when alloyed with silver, copper, lead, zinc, and some other metals, it is partly dissolved by nitric acid. At high temperature it is attached by fused alkalies in the presence of air and by potassium and other nitrates when air is excluded. It is also attached at high temperature by carbon and by silica in the presence of carbon. Platinum vessels should, therefore, never be heated in contact with solid fuel. Cyanides likewise attack it.

Owing to its resistance to the action of acids and most chemical agents even at high temperatures, and to its high melting point, it is in extensive use for the manufacture of crucibles, basins, foils, wire, etc., and for chemical laboratory work. A large quantity is also used in the construction of apparatus for the catalytic manufacture of concentrated sulphuric acid. A considerable amount is consumed in the electrical and dental industries and in the preparation of salts, notably the chloride for photographic work. There has been, also, a large demand for jewellers.

Alloys and Substitutes.

The making of alloys of platinum and substitutes to take the place of platinum has been seriously studied and to some extent platinum has been replaced. There is no question that other combinations or substitutes will be developed in the future, but no substitutes to take the place of the platinum for contact points in magnetos and for numerous other purposes has so far been found. Alloys of gold and palladium, which cannot be told from platinum by ordinary physical properties, are now used in dentistry, jewelry and to a limited extent in chemical apparatus.

Ores of Platinum.

Platinum occurs native in alluvial deposits derived from the disintegration of primitive rocks in the form of grains approximately spherical but less often flattened. Nuggets of large size are rare, but a number of small nuggets are found in the Ural district and one weighing 270 ozs. is recorded by Hautpick as having been found in the placers of Mt. Katchkonara, in the northern portion of the platiniferous district of the Urals, Russia. A still larger one, weighing 21.64 lb., is in the Demidoff Museum, St. Petersburg. The most extensive deposits of platinum are the alluvial sands of the Urals. They are contained within a length of about 80 miles along the central part of the chain in the District of Perm, the principal centres of the placers being at Blogodat, on the eastern and Nijni Tagilsk on the western slopes. This field furnishes the main part of the world's production of the metal. In Columbia, on the Condodo and upper Atrato Rivers are important platinum deposits which are attracting considerable attention at this time and the production of platinum from Columbia is steadily increasing. Platinum is associated in the placers chiefly with gold, iridosmine, chromite, magnetite, zircon, ilmenite, corundum, and quartz. The admixture of gold is variable, ranging from 2 or 3 per cent. in some districts to as much as 75 per cent. or more in others. Among the platinum minerals are iridium, palladium, rhodium, etc., which are intimately combined with platinum and can be separated or determined only by careful chemical analysis.

Occurrence.

The mother rocks of platinum are basic igneous rocks, peridotite, pyroxenite, and dunite. The periodotites and pyroxenites are dark gray to black heavy rocks, composed principally of black or dark green iron magnesium silicates, pyroxene, augite, and hornblends, olivine, plagioclase feldspar, chromite, ilmenite, and magnetite. Dunites are composed principally of olivine with some chromite. There is every gradation between these types of rocks and the less basic rocks. A characteristic of the basic rocks is their tendency to alter to serpentine, a soft, greasy, fibrous mineral of olive green to black color that once seen is readily remembered. Attempts to trace platinum to its source have proved successful in Russia, Spain, and Canada, but no deposit of platinum in the mother rock has been found of commercial grade under normal conditions. It is possible, but does not seem probable, that bodies of platiniferous rock may be found in the United States rich enough in platinum to be worked under present conditions. It should be recalled, however, by all persons searching for platinum ores, that the assay for platinum is difficult and apparently cannot be successfully made by all commercial assayers. It is, therefore, strongly recommended that samples of supposed platiniferous ores be sent only to most reliable analysts.

Black Sands.

Most of the platinum produced in the United States is recovered as a secondary mineral from placer operations and from the electrolytic refining of gold bullion and blister copper. From time to time the beach sands of Oregon and Northern California have been exploited by promoters on the basis of the gold and platinum content. A successful method of mining these sands must be based upon a thorough prospecting of the deposits. Investigation has shown that in general the black sand deposits are disappointing in both quantity and quality, and while in a few places there has been sufficient surface concentration to permit of small mining operations, these deposits rarely contain enough gold and platinum or occur in adequate extent to be operated at a profit.

Metallurgy.

In general, the crude platinum of the western placers is found in relatively small scales or flakes, some larger than one-eighth inch in diameter, but the majority less than one-sixteenth inch in size, many being under one-thirty-

*Reprinted from monthly report of Bureau of Mines, Washington, Oct., 1919, and with the permission of the above department.

sixth inch. The saving of platinum by the ordinary methods of placer mining is carried in suspension to the tailing piles. Undercurrents in the sluice lines have added to the saving of the fine gold, but they are not entirely satisfactory as savers of gold and platinum. Burlap and canvas tables have also been used with some success. Many types of specially designed machines have been tried and discarded, though undoubtedly some have merit and a few are making a fairly satisfactory saving. In the treatment of beach sands concentrating tables are also used.

The loss of fine gold and platinum in ordinary hydraulic operations is due to several causes, among which may be mentioned running pulp too fast and agitating it too much to permit settling, failure to clean up often enough to prevent packing of riffles with consequent formation of smooth slopes over which metals readily flow under pressure, and failure to provide settling boxes for fine material carried in suspension. On some of the gold dredges various devices to effect a closer saving of the fine gold and platinum lost in the tailing have been tried. The most successful has been the Neill jig-Hardinge mill plant, which is in operation on two of the Natoma dredges in California. It was found on some of the other dredges of this company and of other companies in the state that the recovery effected by this tailing plant was not sufficient to justify the expense of its installation. In other words, there was very little platinum or fine gold in the tailing. In addition to the platinum recovered from placer operations some platinum and palladium is recovered from the platiniferous ores of the Boss mine, in Nevada, and the Rambler mine, in Wyoming. These ores are concentrated locally and sent to refiners for final treatment. The crude platinum is separated from the sands and gravels, as already stated, by a series of washing processes. If any gold is present it is obtained in the concentrate together with the platinum. In Russia, the gold is removed by repeated amalgamation with mercury in wood, iron, or porcelain bowls, about 10 to 30 lb. being treated at a time. The crude platinum is then almost all exported to be refined abroad, not more than about 2 per cent. being refined in the country.

Refining.

The "crude" platinum can be refined either by dry or by wet methods. When dry methods are employed any iridium and rhodium present will remain with the platinum; on the other hand, when wet methods are used, the resulting platinum will be pure. A combination of the two methods is also employed. The wet method consists essentially in dissolving the crude platinum in *aqua regia*, precipitating the platinum as ammonia platinichloride, heating the precipitate to redness, forming spongy platinum, and fusing the latter by the oxyhydrogen blowpipes in a furnace constructed of blocks of lime. The refining of platinum ore is a complicated matter.

Hints for Prospectors.

The placer deposits containing platinum are all, so far as known, in the vicinity of areas of basic igneous rocks, and in any search for new deposits of platiniferous gravels the first step is to find outcrops of peridodite, pyroxenite, dunite, and serpentine. When these have been found, the gravels in streams flowing out should be washed to ascertain if platinum is present. The heavy concentrates found in gravels carrying platinum are usually rich in chromite and olivine. The character of the rock particles often gives a clue to the source from which the gravels were derived. Platinum, as it occurs in placer concentrates, is ordinarily a silvery white metal which could be confused only with silver and possibly pieces of iron or steel. It can be distinguished from both of these metals, as they are soluble in dilute nitric acid; crude platinum can be dissolved only in concentrated *aqua regia*, a mixture of 3 parts of hydrochloric (muriatic) acid and 1 part of nitric acid. In some placer deposits the grains of platinum are coated with a dark film and somewhat resemble the grains of the dark minerals chromite, magnetite, or ilmenite, from which they are separated by careful panning, as the specific gravity of platinum is greater than that of any of those minerals.

Platinum will not amalgamate with quicksilver alone, but will amalgamate if sodium is added. In ordinary quicksilver and amalgamation the flakes of platinum float on the surface and can be removed. If sodium amalgam is used, the platinum may be separated from gold by agitating the amalgam with water until all the sodium is used up to form sodium hydroxide; then the platinum will come out on the surface of the amalgam, provided, of course, the amalgam is sufficiently liquid. Platinum can be scratched with a knife. It is so malleable that it can be pounded without heating into very thin sheets. It is practically infusible; the grains can not be melted together as particles of gold can.

A relatively simple chemical test can be made to determine platinum. The metallic particles are dissolved by *boiling in concentrated aqua regia* and allowing the resulting solution to remain on the stove till dry. The residue is dissolved again in hydrochloric acid and evaporated by boiling till the solution is thick, but not quite dry. This mass is dissolved in distilled water and a few drops of sulphuric acid and of potassium iodide solution are added, which, in the presence of platinum, causes the solution to turn a very characteristic wine-red, if much of the metal is present, or to a reddish pink in the presence of small quantities of platinum. The test outlined above is fairly delicate, but it can not be used to detect traces of platinum in the presence of large quantities of iron or other elements.

A second test may be applied to the *aqua regia* solution after the resolution in hydrochloric acid outlined above. In this test potassium chloride (KCl) is added to the solution, which precipitates yellow crystals of potassium platinic chloride ($K_2Pl\ Cl_6$), if platinum is present.

A third test may be applied. Add ammonium chloride ($NH_4\ Cl$) to the *aqua regia* solution, which will precipitate yellow crystals of ammonium platinic chloride, if platinum is present.

The precipitates from tests 2 and 3 are both insoluble in alcohol but are soluble in water and may be reduced to platinum sponge by heating.

All these tests are comparatively simple and positive when made on single grains, but they can not be relied upon when various other elements are present in the material tested. It is, therefore, recommended that their use be restricted to grains of a single mineral picked from the concentrates obtained by panning a sample of either rock or gravel.

ALIENS NOT WANTED AS YET.

That enemy aliens should not, for the present, receive the privileges of English education, was the result of a ballot taken among the students of the Manchester College of Technology, England. The vote arose out of the case of a Bulgarian who desired after two years spent in the College before the war to complete his education under English tuition.

Magnesite in Building Construction*

The General Application of Magnesia Cements to Exterior and Interior Works with the Results of Experiments Introducing Possible Variable Factors in the Composition of Mixtures

By W. C. PHALEN

The production of magnesite was one of the most important of our war mineral developments, not only as regards production of steel, but also in the building trades and operations of the country.

The following table, taken from the report on magnesite for the year 1918, by the United States Geological Survey, indicates the rapid development in this mineral industry during the past five years. For some years, prior to 1914, the normal production of crude magnesite in the United States was in round numbers about 10,000 tons per year:

Crude Magnesite Produced in the United States 1913-1918.

	Quantity (Short Tons)	Value
1913	9,632	$ 77,056
1914	11,293	124,223
1915	30,499	274,491
1916	154,947	1,393,693
1917	316,838	2,899,818
1918	231,605	1,812,601

In the following summary, the use of magnesite in building construction will be more particularly considered.

Uses.

About 65 years ago, a chemist, by the name of S. T. Sorel, discovered that a mixture of zinc oxide and zinc chloride formed an extremely hard cement to which his name was given. This mixture is not now in general use, and the term "Sorel" cement has generally come to mean the cement formed by the mixture of magnesium chloride and magnesium oxide, and certain other ingredients, the latter being used principally as fillers or to produce hardness, or certain color effects. Among the latter substances are wood flour or cork, asbestos, ground quartz or silex, as it is named in the trade, ground talc or soapstone, and various mineral pigments depending upon the desired color effect.

The principal uses for magnesite are in the form of refractory brick, and dead-burned grains for lining open-hearth steel furnaces, crucibles, and electric furnaces. It has also been used in the manufacture of sulphite of magnesium for use in making wood paper pulp; in the manufacture of carbon dioxide; in making fire resisting paints; and as a preventative of boiler scale when sulfurous waters are used. Its different salts are also employed in certain medicinal and toilet preparations.

In the building trades, it makes a very desirable flooring material, which is, at the same time, compact, resilient, and sanitary, and which has sufficient strength to withstand blows and rough wear; is tough enough to prevent the formation of cracks, and is impervious enough to withstand puncture. Unlike Portland cement, it is possible to saw, cut, and insert screws into it. It also possesses resistance to fire and to the passage of heat. Due to these desirable properties, it has been found most useful in the building of monolithic floors, in stucco, and slabs, for insulation and pipe coverings, for the decks of ships, and the floors of freight and pullman cars, and hospitals, and for miscellaneous minor purposes.

Calcination.

The crude magnesite, after being quarried, is broken into small lumps, and for the flooring trade, it is usually calcined in vertical kilns. For the refractory trade, where very much higher temperatures are necessary, rotary kilns, similar to those used in cement plants are in use. In this process of calcination, the moisture and carbon dioxide are driven off. The weight of the latter is about equal to the weight of the magnesia, or, to be exact, the mineral magnesite consists of 52.2 per cent. carbon dioxide, and 47.8 per cent. magnesia. Owing to the presence of small quantities of water, to underburning, overburning, and losses in handling, it is rarely the case that two tons of raw product produce one ton of calcines, but the ratio is larger, viz., 2.25 tons or more of crude to 1 ton of calcines.

The temperature of calcination for caustic magnesite, the kind used in building construction, is important. If the mineral be calcined at a moderate temperature, say 1600° F, or considerably below the temperature of fusion, dissociation is not complete, and the residual product is not inert, but will recombine with carbon dioxide gas and moisture. Such recombination will not take place when calcination takes place at a much higher temperature. In practice, calcination is effected so that from 3 to 8 per cent. carbon dioxide is left in the product which, like quick lime, reacts readily with water and carbon dioxide of the air. In the caustic form, it also reacts with certain compounds like magnesium chloride, and it is upon this reaction that its use in making oxychloride cement depends. It is the custom to calcine magnesite intended for cement at temperatures between 1300° F. and 1700° F., the exact temperature used depending upon the quantity and nature of the impurities present. Magnesite, containing much iron oxdie, may be calcined at a lower temperature than when this ingredient is absent owing to the lower fusion point caused by this, one of the commonest impurities present.

If calcination is carried on at a much higher temperature, say from 2700° F. to 3100° F., all the moisture is driven off, and all except about 0.5 per cent. carbon dioxide. If this is done, or if the material is brought to incipient fusion, then all possible shrinkage is taken up, and the product is known as dead-burned. The product will not slake, as ordinary caustic will, nor will it combine with magnesium chloride to make cement.

Preparation of Cement.

In the preparation of oxychloride cement, the magnesium oxide is mixed with the other dry materials and magnesium chloride is added in the form of a solution. Almost any strength of magnesium chloride solution will produce the effect of setting, but a solution of about 20° Baume (specific gravity 1.16) is usually employed. The magnesium oxide and chloride may be combined in dry form in any proportion desired, and to the resulting mixture, water and the

* A report of investigations made for the United States Bureau of Mines and issued by the Department of Interior October, 1919.

remainder of the dry materials added. This latter method, however, is not satisfactory, and its use has been abandoned. Some manufacturers make a semi-flux mix of cement and solution, and then add the rest of the dry materials. The better way, on the whole, is to add the chloride in the form of a liquid, in which form it may be purchased on the market and reduced to the density desired.

Composition of Product.

The product has been analyzed, and its constitution is believed to conform to the symbol $MgCl_2$ .5 MgO 10 H_2O.

The magnesium chloride formerly used came principally from Germany before the war, and was a by-product in the manufacture of potash salts. Since the war, our needs have been supplied largely from Michigan and from California, where the chloride is a by-product in the manufacture of salt and bromine.

Physical Properties of Cement.[1]

The physical properties of magnesia cement have been investigated by Raymond J. Roark,[2] and his results show what may be expected of magnesia cement when used for flooring purposes. Preliminary tests were made with neat cement, a 1 to 3 mortar of standard Ottawa sand, and a standard floor mix. The standard floor mix, which gave good results, consisted of the following proportions by weight:

Cement	49.3%
Sawdust	29.2%
Asbestos	13.4%
Coloring matter	8.1%

Tests were also made omitting the coloring matter, but keeping the proportions of the other constituents the same. The results showed that the absence of coloring matter had no effect.

At the suggestion of the manufacturer, the magnesium chloride solution was added to the standard mix in the proportion of 85 cubic centimeters to each 100 grams of solids, i.e., one gallon to 10 pounds of solid material. The specific gravity of the solution was about 1.22 (26° Baume).

A sufficient number of tests was made on the three mixes, the neat, the 1 to 3 sand, and the standard floor mix to ascertain whether the three were similarly effected by the different variables, and to ascertain which yielded the most uniform and consistent results. Three cements were used. The first tests were made for tensile strength. The second series of tests was made to check the first series and to compare the results obtained by different operators working simultaneously. Samples were made up of the same three mixes together with the same three cements that were used in the first experiments. A third series of tests was made in which the specimens were made at different times and the tests also to determine the effect of different temperatures and humidities at the time of preparing the specimens, during storage, and at the time of the test. It was found that very considerable differences exist between the results of tests made on different dates.

"The results of these three series of preliminary tests showed that, in general, all tests intended to show the effect of variables other than the amount of aggregate should be made on specimens of standard floor mix; that specimens should be stored in normal air; that tests should be made at any time after three days; and that all tests, the results of which are to be compared quantitatively, should be made at the same time on specimens made at the same time and by the same operator."

A mineral like magnesite varies, and the calcined product from one mine may be different in composition from that of others. The calcined product, however, is a crude material, and to make it uniform, it would have to be treated chemically, which would involve prohibitive expense. Up to the present time, and for this reason, no standard product has as yet been placed on the market, and for this reason again, the consulting architect can make no detailed specification as to the chemical composition of the material he wishes to use unless it is the product of a certain mine with which he is acquainted.

The application of magnesia cement, therefore, is governed by the particular product used and the methods employed will vary with the nature of the cement, weather conditions, and other variables. The specifications are usually restricted to a statement of the results to be accomplished and to the fundamental factors common to all these cements.

In order to gauge the effect of these variables, tests were made to determine the effect of:

1. The chemical constitution of the cement.
2. Variation in the amount of $MgCl_2$ solution; density constant.
3. Variation in the density of the $MgCl_2$ solution; amount constant.
4. Variation in both the amount and density of the $MgCl_2$ solution; amount of $MgCl_2$ constant.
5. Variation in the proportion of cement to aggregate.
6. Variation in the moisture content of the aggregate.

To determine the effect of the variables listed, tests were made as follows:

1. Tension test.
2. Compression test.
3. Cross-breaking test.
4. Hardness test
5. Expansion test.
6. Change in weight test.
7. Pat test.

The results of these tests are summarized in part as follows:

1. The standard floor mix, gaged with a magnesium chloride solution having a density of 1.20 (24° Baume), in the proportion of 85 c.c. of solution to 100 g. of solid material (1 liquid gallon to 10 pounds) was found to have:

An average tensile strength of 593 lbs. per sq. in.
An average compression strength of 2340 lbs. per sq. in. at 7 days, and of 4000 lbs. sq. in. at 28 days.
An average modulus of rupture of 1200 lbs. per sq. in.
An average modulus of elasticity of 650,000 lbs. per sq. in.
An average Brinell hardness number of 7.3.
A coefficient of expansion of 0.0000126 per degree F.

2. Specimens made of this mix were found, in general, to increase in strength as time went on, and the increase in compressive strength was greater than the increase in tensile strength; but in some instances a decrease in tensile strength was noted.

3. Specimens of this mix were found to expand during setting, and for some time afterward. In a dry atmosphere, the maximum expansion varied from .10% to .30% and occurred in from 70 to 140 hours. After that time, the specimens bega nto shrink and the ultimate length

[1] Abstracted in part from an article in The American Architect, Vol. CXIX, Nos. 2229-2231, Sept. 11-25, and Oct. 9, 1918.

[2] Engineering Experiment Station, University of Wisconsin, Bulletin 879.

of same was less than the original. In a moist atmosphere, the specimens began to shrink and the ultimate length observation. The rate of expansion varied.

4. The weight of specimens, as a rule, decreased during storage in a dry atmosphere, but increased during storage in a moist atmosphere.

5. It was found, in general, that the strongest mixtures were those made with cements having a high magnesium oxide content, and a low lime content. The addition of lime was found to produce a marked decrease in tensile strength. No consistent relation was found to exist between the strength and the amount of any other chemical constituent of the cements.

6. The tendency to shrink or expand was not found to bear any relation to the chemical constitution of the cements.

7. The maximum strength and hardness were obtained with that quantity of magnesium chloride solution necessary to give good working consistency, that is, with about 85 cubic centimeters of solution, to 100 grams of solid material (1 gallon per 10 pounds).

8. In a dry atmosphere, the per cent. of expansion of the specimens was found to increase with the quantity of solution used; in a moist atmosphere, the per cent. of expansion was found to decrease with the quantity of solution used.

9. In dry air, the per cent. of loss in weight of the specimen was found to increase with the quantity of solution used; in moist air, the per cent. of gain in weight was found to increase with the quantity of solution used.

10. The strength, stiffness, and hardness were found to increase with the density of the magnesium chloride solution used. A density of 1.15 appears to be the least that should be employed in any case.

11. In a dry atmosphere, the percentage of expansion of the specimens was found to increase with the density of the solution; in a moist atmosphere, it was found that the percentage of expansion varied at first inversely, and later on, directly, as the density of the solution. The relation between percentage of expansion and density of solution between percentage of expansion and density of solution do not, however, appear to be clearly defined.

12. In dry air, the percentage of loss in weight of the specimens was found to vary as the density of the magnesium chloride used. In moist air, the percentage gain in weight was found to vary indirectly as the density of the solution.

13. The results of the tests on mixes in which different quantities of solutions had been used, but in which the quantity of magnesium chloride was practically the same, showed that strength and hardness increased with the amount of solution so long as this amount was less than that required to give normal consistency. This shows that the physical properties of the mix are not dependent simply upon the ratio of magnesium chloride to magnesia, but depends also upon the quantity of water used.

14. Strength and hardness were found to increase with the ratio of cement to aggregate. This increase became less marked as the richness of the mix was increased.

15. The tendency to expand was found to increase with the ratio of cement to aggregate.

16. Tests made on mixes in which the aggregate had been moistened before mixing, in order to secure normal consistency with less magnesium chloride solution, showed that the strength varied directly with the amount of solution used.

17. The time of set was found to be effected by the temperature and humidity, and also by the density of the magnesium chloride solution. High temperature, low humidity, and the use of a dense solution were found to produce quick setting of the cement.

Use in Interior Work.

Magnesia cement, or magnesium composition flooring, has been compared with other flooring materials.[1] It differs from other flooring materials with the exception of asphalt, concrete, and terrazzo in that it is installed in the plastic condition. Floors made of magnesia cement may cover quite a range of hardness which is accomplished by varying the character of the aggregate, for example, by using variable quantities of sand. The harder the floor, naturally the more noisy it will be as compared with a less dense and resilient floor made from such materials as wood fiber, saw-dust, or cork. The resilient floor is quiet, elastic, warm, and agreeable to the tread, and the wearing quality of such floors is considered to be equal to that of the hard type, in which silica sand is largely used.

Magnesia cement flooring may be planed, drilled, scraped, and burnished. The extent to which it may be thus treated depends naturally upon the character of the aggregate. The resilient floors are more easily worked. Such working qualities of magnesite cement are marked when compared with concrete, which is brittle, and unelastic.

Magnesite cement floors may be colored with mineral pigments. Such colors as red, buff, or black appear to give the best results, but grey shades may be made by mixing white and black. Other colors are apt to fade, and are not so desirable. Floors may be laid in two or more colors, the added cost depending on the design and arrangement.

The foundation provided for the magnesite cement floors is of importance. Lime is detrimental and it is necessary that all traces of it be removed from the foundation. The floors should be laid in two layers, an underlayer 3-16 inches thick, and a toplayer 5-16 inches thick. In the case of wainscoting or closet floors, a thickness of 3-8 inches is ample. The surface should be brought to a true plane with a trowel, and should have a uniform color. Burnishing, rubbing, or scraping should not be resorted to. The finished floor should be protected with ½-inch layer of sawdust or fine shavings. The temperature of the room where such a floor is being installed should not be less than 50° F. Such floors should be guaranteed for a period of at least two years.

Use in Exterior Work.

The qualities of magnesia cement requisite for success in exterior finishing are resistance to abrasion, impact and structural stresses. Durability when subjected to the action of the elements and stability to minor disarrangements of the base on which it is placed are of importance. It must be relatively unaffected by changes in temperature, by the action of water, and the elements in general should adhere to the material on which it is placed, and should be free from shrinkage cracks due to setting up the material.

The elasticity of such cement is the outstanding quality which makes it desirable for exterior work. It also possesses the ability to adhere to all materials in a marked degree. Its freedom from expansion and contraction after setting is one of the principal reasons for its adhesive

[1] See American Architect, July 24, 1918, page 116.

quality. It may be applied to old brick or stone walls, even though they have been repeatedly covered with paint, and the quality of adhering to wood makes it possible to secure a weather proof protection to the wooden casings and trim of exterior openings. The quality of adhesion and elasticity is easily proved by applying a ½-inch layer to a 1-inch board which has been first covered with metal lath. Such a board, about 8 feet long, may be repeatedly deflected about 3-inch in the center without breaking the bond to the board, or causing any cracks to appear in the magnesia cement. The ability to resist fire as well as the possession of insulating qualities are also desirable characteristics of magnesia cement stucco.

Magnesite cement stucco should be applied in two coats, each ¼-inch thick on various surfaces such as wood lath, metal lath, sheathing board, brick, hollow tile, or stone; care being taken as regards the presence of lime, unless the same has been rendered, or become inert as with very old walls. The first coat made up to a consistency that works easily under the trowel is applied in the usual manner. No water should be added to the liquid chloride, as it would alter its density and injure the work. The second, or finishing coat, is then applied. The aggregates are different in each, and no other dry material should be added to them as they come to the trade. The cement may be applied in zero weather without damage. Setting is quite slow under such conditions, but the cement ultimately becomes hard. It should always be applied to a dry surface excepting that under certain conditions it is desirable to apply a solution of magnesium chloride before using the stucco.

The temperature is of importance. If the temperature is over 50° F., only so much of the first coat should be applied in one day as can be covered with the second coat. In this way, the finishing coat is applied before the first coat has become hard. If the temperature is below 50° F., the finishing coat can be applied 24 hours after the first coat is applied.

Magnesia cement stucco may be colored with any mineral color or combination of such colors. The factory-made product is produced in colors, and thus prepared, the shade is uniform.

Conclusion.

Magnesite is an important material for building construction both in flooring and in exterior stucco. It possesses certain physical properties adapted to such uses that are not common to other materials. As stated above, the product is not yet standardized, and to secure satisfactory results, the architect using it has to be careful both as to its selection and use for specific purposes. This applies likewise to the contractor who is to apply the material. It is hardly necessary to add that the raw material and workmanship must be good in order to avoid unsatisfactory results; but these are essential conditions to all the elements entering into satisfactory building construction.

FIXATION OF ATMOSPHERIC NITROGEN.

The British Cyanides Co., Ltd., announce that the experiments on the fixation of atmospheric nitrogen, upon which large sums were expended prior to the war, and necessarily suspended during the war, have now been resumed. These experiments will take many months to develop, but the special furnaces which have been erected have already satisfactorily overcome some of the chief difficulties which the company before the war were endeavoring to solve.

PRODUCTION OF TALC AND SOAPSTONE.

Raymond B. Ladoo, of the United States Bureau of Mines, in a recent report of that Bureau, gives some very interesting facts on the talc and soapstone industries. We quote in part from Mr. Ladoo's report:

Talc and soapstone, together with pyrophyllite (usually sold as talc), are very widely distributed over the earth. Deposits are known in nearly every country, but the production on a commercial scale has largely been confined to the countries of highest industrial development. Thus the United States produces about 65 per cent.; France, 13.4 per cent.; Italy, 7.4 per cent; Germany and Austria, 5.4 per cent; and Canada, 4.7 per cent. While the most valuable grade of ground talc is that used for toilet purposes, by far the largest production is of the lower grades, used in the manufacture of paper, rubber, paint, prepared roofing, and other industrial uses. Since the lower grades of talc will not stand high transportation charges, it follows that the greatest production will come from the countries and districts which have best developed the industrial uses. In the United States, Germany, and Austria, many uses have been found for the lower grades of talc. In France and Italy the principal product shipped is high grade talc for toilet purposes and massive talc for the manufacture of lava, but some use is made of the lower grades. In most of the other producing countries there is little or no market for anything but the highest grades. Thus India, Brazil, Japan and Spain, with many known deposits, produce only small quantities. The accompanying table indicates the approximate distribution of production:

(In 2,000-lb. tons)

Country.	1911.	1912.	1913.	1916.	1917.	Per cent. of total
U. S. (a)	143,551	159,270	175,883	212,961	218,848	65.0
France (b) ...	44,092	60,629	66,332	.....	45,000*	13.4
Italy (c)	15,600	15,800	23,530	28,586	25,000*	7.4
Canada (c) ...	7,300	8,270	12,250	13,104	15,803	4.7
Austria (c) ...	15,212	.....	.....	.....	15,000*	4.4
Norway (c) ..	.....	885	1,653	6,063	6,000*	1.5
Spain (d)	6,226	.....	.....	1,062	5,000*	1.5
Germany (Bavaria) (d) ..	3,728	3,551	.....	.....	3,500*	1.0
India (c)	689	882	1,350	1,010	1,900	0.6
British South Africa (c) ..	.....	.....	.....	132	785	0.2
Total					336,836	100.0

* Statistics unavailable. Figures represent producing capacity estimated for obtaining approximate world production.

.... Statistics unavailable.

(a) Talc and soapstone.

(b) Talc, soapstone and asbestos.

(c) Talc.

(d) Soapstone.

The State of Vermont, in the United States, is the largest producer of any of the States, producing in 1917 93,960 short tons. The entire production of soapstone in 1917 in the United States came from Virginia, where 20,235 tons were produced.

France.—The most important producing properties in France are in the Department of Ariege. Important deposits are at Montferrier, in the Pyrenees, about twelve miles from the Spanish line, and at Luzech. Another producing district is at Luzenac, near the port of Cette. Eighty-five per cent. of the production comes from the Department of Ariege.

Italy.—The highest grade talcs in the world are mined in Italy. Their superior color, freedom from grit and impurities and fineness of grain make them especially suited for toilet and medicinal uses and for lava blanks. The main producing district is in the Italian Alps in the neigh-

borhood of Perosa, south of Turin, in the Valle di Chisone. It is also mined near Pinerolo and in the valleys of San Martino, Susa and Lanzo.

Austria-Hungary.—Austria before the war produced a tonnage equivalent to about 4.4 per cent. of the present world production of talc and soapstone. The principal deposits of talc in **Austria** are in the Province of Styria in the communes of Mautern, Aflenz, Anger, Pollau, St. Kathrein and Floing. Other producing districts are in Salzburg, Grusserhof and Rohoncz, **Hungary.** The talc is of high grade, but not equal to that from Italy. Much of the Austrian talc was used in Germany for paper making. Austrian producers before the war were keenly alive to the possibilities of utilization of talc, and formed an association which published results of research and notes on many new uses.

Spain.—Talc production of Spain is small, and comes principally from the Province of Gerona, in the Pyrenees, but one mine is repoted in the Province of Malaga.

Germany.—Important talc deposits are reported at Gopfersgrun, near Wunsiedel, in the Fichtelgebirge, Bavaria, from which most of the German production came before the war.

India.—Massive talc of excellent quality has been mined in India for years, the natives making use of it for pots and kettles, but export trade has become of importance due to the particular suitability of Indian talc for lava manufacture. The largest production at present comes from the Jabalpur district in the Central Provinces. Other producing districts are in the Provinces of Madras, Rajputna, Mysore, Bengal, Burma, Bombay, and Central India. Veins are usually thin but of high grade. Resources are said to be large.

British South Africa.—Talc is found in Natal and Rhodesia, but the most important production comes from the Barberton district in the Transvaal. Large bodies of more or less pure talc occur both in Rhodesia and Transvaal. In the Barberton district pencils, tailors' chalk, billiard chalk and ground talc are produced. An important industry sprung up during the war, and practically all local needs were supplied. It is stated that a large export trade is looked for when shipping becomes normal.

Brazil.—While no export trade in talc or soapstone is reported, Brazil promises to be a future source of importance. A very pure white talc is reported at Rezende, State of Rio de Janeiro. Deposits at Lorena and Santo Amaro, both in the State of Sao Paolo, are also being worked. Good grades of massive talc, at present worked only by natives for local uses, occur near Itaberaba, Bahia; Municipio de Ouro Preto; Varzea, near Dores de Boa Esperanca; near Jacuhy, in Western Minas Geraes, and in the State of Ceara, and Goyaz.

China.—Massive talc or high-grade soapstone has been mined for years in China for the manufacture of carved utensils, images and ornaments. Much of the material, while ideal for carving, is too highly colored for ground talc. The principal district has been the Tsintien region, Chekiang Province, about forty-two miles from Wenchow. It is also found in the Provinces of Chihli and Fukien.

Norway.—Talc and soapstone both occur in Norway. Soapstone from Gudbradsdal is used in the Cathedral of Trondhjems. Mills for the grinding of local talcs have been erected at the Songefjord, north of Bergen and in Cistesto, Vikor, south of Bergen.

Japan.—Both talc and pyrophyllite are found in Japan in the provinces of Hitachi, Kozuke, Musachi, Omi, Bizen, Suo, Hizen, Higo, Harima, Bingo and Aki. Small imports of Japanese talc have been received in this country, and it is probable that Japan is a potential source of some importance.

British Isles.—While the mining of talc and soapstone is not of importance to-day in the British Isles, several deposits are known and have been worked. Among these may be mentioned the Lizard district in Cornwall; Crohy Head and Gartan, near Letterkenny in County Donegal, Ireland; the Shetland Isles; the Hebrides (Harris); and Shiness, in Sutherland.

Talc of a grade suitable for paper, etc., is reported as occurring near Heathcote, **Australia.** Deposits of talc of various grades occur in **French South Africa, Jamaica, Sweden,** the **Netherlands and Belgium,** from which countries small imports into the United States have been received. Talc of excellent quality, but in small quantities, comes from **Syria, Mexico, New Zealand,** and in, fact, almost every country possesses some resources of talc or soapstone.

Canada.

Canadian talcs, the report states, generally command a slightly higher price than those of the eastern United States, some being suitable for certain grades of toilet powder. Most Canadian talcs are used in the industries which demand a medium high grade talc. The principal use of talc in Canada is as a filler for paper. For this purpose it should be very finely ground, free from grit, and as nearly white as possible for the better grades of book paper. It is used as a filler to be added to the pulp to produce a white opaque paper and also in the coating of paper. The principal production in Canada comes from a group of mines near Madoc, Hastings County, Ontario. A second deposit has lately been opened up in this district at Eldorado. Two mills are in operation grinding crude talc and preparing it for the trade, viz., George H. Gillespie and Co., Madoc, Ont., and Canadian Talc and Silica Co., Ltd., Eldorado, Ont. The industry is growing in Canada. The value of talc mined in the Dominion in 1918 was $112,000, which compares with $76,539 in 1917 and $40,418 in 1914. Several small mines have been operated in Brome, Megantic, Montmorency, and Wolfe Counties, Quebec; and in Cariboo Co., and a few other localities in British Columbia. The production of the Madoc district has been rapidly increasing and probably will be an increasingly important factor.

Some Uses of Talc.

Powdered talc is used in large quantities in the manufacture of talcum powder; a filler or loader in the cheaper grades of toilet soaps; for filling and dressing cotton cloth white; in the preparation of cloth for window-blinds; as a foundry facing; as a filler in the preparation of rubber; in the making of enamel and other paints; in the composition of magnesite flooring; sometimes used in the insulating composition of electric cables; in the making of gas burners, slate pencils, tailors' chalk, and in white pencils pure grades of massive talc are used.

Soapstone, while found in Canada in small quantities in the deposits where talcose mineral occurs, is not mined to any large extent, such soapstone as is used in Canada is purchased already manufactured into the desired sizes and shapes. Among the many articles which may be made from soapstone are: Electric switchboards, laboratory table tops, wash tubs, furnace linings, acid tanks, and sanitary fittings.

BOOK REVIEWS

"The Mineral Industry." Its Statistics, Technology and Trade during 1918. By G. A. Roush and Allison Butts. Volume XXVII. McGraw-Hill Book Co., Inc., New York. 937 pages. Price, $10.00.

A list of the contributors, thirty-six in number, is sufficient to interest the reader immediately. Men of broad knowledge, who have had the opportunity from the nature of their work to consider topics from a world standpoint, have given in concise form the development in their respective fields during the year. The book gives a summary of world conditions, and it cannot be said that undue stress or detail has been allowed when considering the industries of the United States. A very fine balance is maintained in all sections. The relative importance of subjects has been carefully studied, and the work has all been written up in a most readable and pleasing style.

An alphabetical arrangement of subjects has been followed from abrasives to zinc. In all cases, Canadian conditions and developments are most completely treated and Canadian Government reports and technical literature have been used. The chapter on Molybdenum was prepared by Alfred G. Wilson, of the Mines Branch, Ottawa. When world conditions are in review, it is an indication of the importance of Canadian mining industries to know that in many instances Canadian resources must be considered of the very first importance.

The chapters of most general interest are those on Coal and Coke, Copper, Iron and Steel, and the extended report on Ore Dressing and Coal Washing. The first three of these, like other chapters, carry the story of the war, and will become historical records of achievements under stress. The general nature of the chapter on ore dressing and coal washing makes it suitable not only for the average technical reader, but for the man who wishes to have the boiled-down results of improvements made and knowledge gained during the year. The main lines of advance seem to have been in the production of larger crushing-machines, in the study of ball-mill work and of crushing in general, in the consideration of screening before concentration, in the proper application of flotation, and in the simplification of flow-sheets.

While it takes all varieties of technical literature to make a library, every credit must always be given to those who by their co-operation make possible a work of historical reference which would be quite beyond the scope of any individual. For those who have previous volumes, the announcement of the 1918 edition will be sufficient, while to those who are not familiar with this series, it can only be suggested that one of the best reports of the year on the subjects covered is now available. L. E. W.

"The Metals of the Rare Earths." By J. F. Spencer, 279 pages. Price, $4.50. Longmans, Green & Co., New York, N.Y.

The interesting historical discovery of rare earths is dealt with at length in the opening chapter. The author proceeds to show how the use of the gas mantle developed a use for certain of the rare earths. This soon led to extensive deposits being found in different countries, and industries thereby established.

Methods of separation and identification are given which are comprehensive and complete. The book deals with the purely chemical side of the question, and at the same time indicates the practical application of many of the rare earths to the arts and industries. The work is such that it should be interesting to any chemist, but is indispensable to one interested in the subject itself. The bibliography is particularly good.—L. J. Rogers.

Bulletin No. 1, School of Engineering Research, University of Toronto, 1919. 243 pages.

Fourteen original papers are given, reporting research work done in the School of Engineering Research, connected with the University of Toronto since 1917. The field covered includes various branches of engineering. The papers in detail are:

(1) "The Investigation of Girderless Concrete Floors," by Peter Gillespie and T. D. Myhea.
(2) "An Improvised Vibrometer," by G. R. Anderson.
(3) "Preliminary Report on an Investigation Into the Concentration of Graphite from Some Ontario Ores," by H. E. T. Haultain, F. C. Dyer and J. T. King.
(4) "New and Rapid Apparatus for Electro-Chemical Analyses," by J. T. King.
(5) "A Research on a Four-inch Single Stage Turbine Pump," by J. H. Parkin.
(6) "The Strength of Cast Iron in Bending as Affected by Variations in Cross Section," by J. H. Billings.
(7) "Heat Transfer Tests of Building Materials," by L. M. Arkley.
(8) "The Fusion of Sodium Hydroxide with Some Inorganic Salts," by Maitland C. Boswell and J. V. Dickson.
(9) "The Action of Sodium Hydroxide on Carbon Monoxide, Sodium Formate and Sodium Oxalate," by Maitland C. Boswell and J. V. Dickson.
(10) "The Fusion of Sodium Hydroxide with Several Phenols and Sulphonic Acids," by Maitland C. Boswell and J. V. Dickson.
(11) "The Absorption of Arsenious Acid by Ferric Hydroxide," by Maitland C. Boswell and J. V. Dickson.
(12) "The Calculation of Transmission Line Networks," by T. R. Rosebrugh.
(13) "The Overload Limitations of High-Voltage Single-Turn-Primary Current Transformers," by W. B. Buchanan.
(14) "A Process for Electrolytically Refining Nickel," by G. A. Guess.

NEW ITALIAN CHEMICAL JOURNAL.

A new monthly journal has been established by the co-operation of Italian Industrial Societies.

The *Giornale di Chemica Industriale* will correspond in Italian to the French *Chimie et Industrie*, and the English and American journals covering similar fields.

Italian chemists have already contributed much to the development of various branches of chemistry, and the new journal should assist in expanding the industrial field in Italy as well as giving the world a better appreciation of the growing progress of industrial chemistry within the country.

Offices of publication are at 10, Via San Paolo, Milan. The annual subscription in America is 40 lire.

Manitoba Society News.

At the annual meeting of the Manitoba Chemical Society, held in October, the following officers were elected: Secretary, Dr. J. W. Shipley, Dept. of Chemistry, University of Manitoba; Treasurer, E. L. C. Forster, Public Analyst in Charge Dominion Health Laboratories, Winnipeg. Committee, W. Sadler, Science Master Central Collegiate Institute; A. Blackie, City Chemist; Dr. H. P. Armes, of the Chemist Dept. of the University of Manitoba; and A. W. Alcock, Grain Research Laboratory, Winnipeg.

On November 4th, Dr. A. T. Cameron gave an illustrated lecture on "War and Water" before this Society. The meetings are all open to the public and every opportunity is being taken to broaden the general conception and appreciation of the relationship of Chemistry and Chemists to the general life of the community and to industry.

Toronto Electro-Platers Meet.

A most successful and largely attended meeting of the Toronto Section of the American Electro-Platers' Society was held in the lecture room of the Chemistry and Mining Building of the University of Toronto, on Saturday evening, November 22nd, when Dr. William Blum, of the Bureau of Standards, Washington, D.C., delivered an illustrated lecture.

It goes without saying that when such a well-known authority as Dr. Blum was the speaker, the subject was ably handled. That is, indeed, putting it mildly. It was, perhaps, the most instructive and interesting deliverance on electro-plating ever given in Toronto, and the Toronto Section are to be congratulated on having secured the services of Dr. Blum for the evening.

The president of the Toronto Section, Mr. J. A. Magill, of the Monarch Brass Company, presided, and in introducing Dr. Blum referred to the fact that the Toronto Section was the only Section of the American Electro-Platers' Society in Canada. He also pointed out that the society was entirely educational in its nature, with no other object or ideals than the advancement of scientific knowledge amongst its members.

Previous to the main lecture, Prof. J. T. Burt-Gerrans illustrated the changes taking place in a cadmium cell, by projecting its image on the screen. The lighting arrangement allowed for very clear observation of reactions taking place in the cell.

Dr. Blum, in his opening remarks, declared that the successful future of all industry depended on the application of science and knowledge to industry. There was, he said, too little connection between science and industry and too much of a divergence between the "practical" man and the "theoretical" man. No sharp line could be drawn between the practical and the theoretical, and the only difference he could see between the two was that the "practical man has more theories than the theoretical man, and they are all wrong."

Science had made many predictions, which are on record as culminating as foretold. Witness the fact that, when an unknown gas was discovered in the spectrum of the sun, it was predicted that when more was known about it, it would have the qualities and properties of helium, and such had since been amply proved. Dr. Blum then went on to discuss the axioms on the deposition of electro-deposited metals laid down by Dr. Bancroft in 1904. There were few, if any, exceptions to these axioms, but it was necessary that they be stated in terms that could be understood and illustrated by simple experiments.

The size and shape of the crystals of a deposit had a distinct relation to the structure of the deposit. This was illustrated by several lantern slides, showing that fine-grained crystals produce rough deposits. Another series of views shown illustrated the fact that a high current density produced finer deposits than low current densities, that is, up to a certain point. A little over 30 amperes per square foot was about the limit, with the solutions and under the conditions of experiments illustrated, for when the current density was increased beyond that, the current efficiency decreases and hydrogen is evolved, causing bubbles and secondary reactions between hydrogen and the metal. This was illustrated by views of copper, zinc, and nickel deposits, in every case using the same metal, i.e., plating copper on copper, etc.

A point that Dr. Blum strongly emphasized was the agitation of the solution while the plating process was proceeding. Agitation produced finer grained deposits as the stirring swept away the hydrogen bubbles and strengthened the solution at the cathode. There was much yet to be done along the line of agitation, he said, and advised closer attention to this factor. There was a larger field for development in agitation than was commonly thought. Coarse deposits were produced at higher temperatures; this was true despite the fact that nickel solutions are often heated to produce fine grained deposits, but, in that case, it was not the temperature that gave the result, but the higher current density obtained. Additions of glue to solutions gave a fine mirror-like deposit, and in many cases only a very small amount of glue was necessary.

So far as the solutions used were concerned, there were several points to be observed in securing a suitable one. As outlined by Dr. Blum these were: Solubility, conductivity, ability to corrode the cathode, low metal ion concentration, good throwing power, reasonable price. In regard to the "throwing power," Dr. Blum said there was room for considerable research work along this line, as it was not known just exactly why some solutions had better throwing powers than others. While on this point, Dr Blum advised that the assistance of the chemist be secured while solutions were going well, and not after so many additions had been made that no chemist could determine what was originally put in.

An interesting view was shown of a large, narrow tank, constructed at the Edgewood Arsenal for the plating of shells with lead. Thousands of shells had been thrown aside as of no value, being underweight, but by using a lead fluoborate solution, it was found possible to plate lead on the shells, bringing them up to standard and saving thousands of dollars to the government.

In conclusion, Dr. Blum declared that, if the problems of the higher cost of living were to be met by greater production, then science must be linked up with, and applied to, industries. He also urged those present to put into daily practice whatever of research, sciences, or knowledge that they knew.

A pleasing feature of the evening was the presentation to Dr. Blum by Dr. Lash Miller, on behalf of the Toronto Section, of a beautifully plated comport, the work of some of the members of the Toronto Section.

Dr. Miller in his usual enjoyable style, told something of the history of the work done by Toronto electro-platers at the Technical School. This work had prospered and was now recognized as of the greatest value to the men, the plant managers, and those interested in assisting returned soldiers to obtain suitable training in these lines.

SOCIETY CALENDAR.

American Institute of Chemical Engineers. Twelfth Annual meeting, Savanna, Georgia, December 3 to 6 at Hotel De Soto. J. C. Olson, Secretary, Polytechnic Institute, Brooklyn, N.Y.

American Waterworks Association. Fortieth Annual Convention. Montreal, Windsor Hotel, week of June 21, 1920. Secretary, J. M. Riven, 153 W. 71st Street, New York.

American Chemical Society. General Spring meeting. St. Louis, Missouri, April 15 and 16, 1920. Secretary, Chas. L. Parsons, 1909 G Street N.W., Washington, D.C.

A new chair of Physical Chemistry has been established in the University of Bristol, England, on the endowment of Lord Leverhulme. Captain J. W. McBain, lecturer in Physicial Chemistry at the University since its foundation, has been appointed to the chair.

PERSONALS

Mr. F. W. Baridon of the staff of the Mines Branch, Ottawa, has left for Buenos Ayres where he will be engaged in metallurgical work.

R. T. Elworthy, B.Sc., A.I.C., who has been with the Admiralty Inventions Board for the past two years has returned to Ottawa, and is again at the Mines Branch.

Captain J. T. Janson, B.Sc., A.I.C., D.S.O. with bar, has returned to the Laboratories of the Experimental Farm, Ottawa. Captain Janson is a graduate of London University, who came to this country in 1912 to accept a position in the Department of Chemistry, University of Toronto. The following year he joined the Staff of the Division of Chemistry, Experimental Farm, Ottawa, and when the war broke out he returned to England, where he enlisted with the King's Own Yorkshire Light Infantry, with whom he went to France in 1915. Captain Janson was one of the fortunate ones, coming through the whole period of the war without a scratch, and his decorations indicate that he was in plenty of active service.

O. G. Lye, B.A Sc., has resigned his position as Public Anaiyst in the Food and Drug Laboratory, Department of Public Health, Ottawa, to accept the position of Chief Chemist with the Malt Producers Company of Canada. at Guelph. Mr. Lye, who was formerly with the Dominion Canners, at Simcoe, went overseas in 1914 with the Princess Patricias, and when he returned to Canada, he joined the staff of the Food and Drug Laboratory.

Mr. P. J. Moloney, M.A., is leaving the Division of Chemistry, Experimental Farm, Ottawa, to take up work with the Connaught Antitoxin Laboratories at Toronto.

W. Victor Kitto, B.A., of the Staff of the Food and Drug Laboratory, Ottawa, has returned to the University of Toronto, where he will do post-graduate work in Biochemistry and Physiological Chemistry.

Harold J. Brownlee, M.A., a graduate of the University of Kansas, Lawrence (Kas.), formerly assistant in electrochemistry at the University of Toronto and captain in the United States Engineers, A.E.F., has been appointed lecturer in Chemical Engineering at Toronto University. Mr. Brownlee was formerly research Chemist at the Redmonal Chemical Products Co. Ltd., Chicago, Ill.

Mr. H. V. Vickery, Secretary of the Maritime Chemists' Association, has left the Imperial Oil Refinery at Dartmouth, N.S., to take a position on the staff of the Truro Normal School. Mr. Dimmit of the Sarnia Refinery has been transferred to the Dartmouth Refinery, following Mr. Vickery.

Mr. C. J. Brockbank, who has been manager of the Exolon Works at Thorold, Ont., since its erection several years ago, has left that position and has gone to England where he will be in the employ of the British Government, giving lectures on abrasives. Mr. Brockbank is regarded as a high authority on the manufacture of abrasives. During his residence at Thorold, he was elected Councillor and Mayor successively.

Mr. J. V. Dickson, of Toronto, has taken a position as Instructor in Chemistry on the staff of that Department at Columbia University, New York.

Lieut.-Col. H. R. Lordley, C.E., M.E.I.C,, of Montreal, has been chosen for a Fellowship in Engineering at Cornell University. He was elected a Fellow of the Society of Engineers, London, England, because of his record in engineering work while in France with the Imperial forces.

Dr. J. W. Shipley, formerly Professor of Chemistry in the Manitoba Agricultural College, has resigned to accept a position as assistant Professor of Chemistry at the University of Manitoba, Winnipeg.

Mr. C. F. Kendall, for some years salesmanager for the Martin-Senour Co., of Montreal, has joined the staff of McArthur Irwin Ltd., Montreal, as manager of their Paint and Color works.

Mr. G. G. Ommonney, has been appointed Investigation Engineer attached to the staff of the Department of Colonization and Devolpment, Canadian Pacific Railway, Montreal. He will devote his attention to the natural resources tributary to the system, paying attention to the utilization of waste products and general Industrial Research.

THAT "SCHOOL REUNION."

One fine evening in Folkestone, early in 1915, a murmur was heard in the distance, which, drawing closer, developed into the wild chant of the "School Men." Then from every direction the cry was taken up, and soon from every street hurrying and shouting groups of khaki-clad Canadians were issuing to join the numbers and swell the slogan of the gathering School and 'Varsity men.

The great war is over and most of the boys are home. Once more the beacon has been lighted and the slogan of the "Old School" is sounding across Canada and the United States, and all good school men are gathering to the Alma Mater. Why at this time? To swear allegiance to the new chief, Brig.-Gen. Mitchell; to renew the friendships and acquaintances of school days so disrupted by time and the war; to call the roll of the clan and find out just who are missing and the present location and pursuits of the others; to take advantage of the existing wealth of *esprit de corps*, and re-organize and consolidate their numbers into a strong, active Alumni Association.

It appears that the Alumni is going to pull one of the biggest things that has been put over at 'Varsity for many a day. The programme that covers Friday night, December 12th, and all Saturday, December 13th, looks like a good time for everybody. and the graduates from out of town are being offered first consideration.

Owing to restrictions on the use of Hart House for dancing, the Committee has done the next best thing in securing the New Masonic Hall for the more or less formal Friday night dance.

Saturday morning is reserved for business—the registration of the graduates and a joint meeting of the Engineering Society and of the Alumni in Convocation Hall. Class Alumni Luncheons are being arranged and theatre reservations en bloc made for those who so desire, in the afternoon. It is also expected that a reception will be held in the School Buildings in the afternoon, when the latter will be open for inspection, and tea served. Saturday night concludes the programme with an Alumni Dinner at Hart House.

As accommodation for the dance, dinner and theatre is limited, applications for tickets, accompanied by cheque, should not be delayed.

The Committee in active charge are: Messrs. R. J. Marshall, '08; F. S. Rutherford, '14; C. E. Macdonald, '18; J. Bannigan, '17, Secretary. All communications should be addressed to the Secretary.

DAVID GILMOUR, C.B.E.

Recently an important change occurred in the executive of the Standard Chemical Co., Limited, Mr. David Gilmour, C.B.E., having been appointed to the presidency of this concern.

The new President, Mr. Gilmour, is a Member of the Institution for Civil Engineers (England), and a former president of the South African Institute of Engineers. He has had wide experience in various enterprises in South Africa, South America and the United States, and has been consulting engineer to some of the largest mining companies of the world. During the war his services were used by the British Government in their Department of Explosives Supply, assisting in the designing and operation of many explosives plants. The control of the erection and operation of the largest munitions factory in the United Kingdom—H. M. Factory Gretna—from its inception was placed in his hands, and, at the time of the Armistice, he was co-ordinating all the activities relating to the large plant then in course of construction near Middlesboro, for the manufacture of ammonium nitrate from synthetic ammonia. Just prior to joining the Standard Chemical Company he was Director of Factories Branch for the Department of Explosives Supply. He was also a member of a Commission sent by the War Office to France to investigate various labor questions in connection with the British Army's organization in the field.

It is indeed fortunate, not only for the Standard Chemical Company, but for Canadian industries in general, that the Standard Co. has for its President a man who fully realizes the value of research to chemical and allied interests, for Mr. Gilmour stated recently, in an interview with a representative of the Canadian Chemical Journal, that no industry can get on to a solid competitive basis without the help of scientific research. "Applied research," said Mr. Gilmour, "is all essential to the proper conduct of any industry, but as to its monetary value, that depends on the objective; for there must be an industrial objective and intelligent guidance towards it by those responsible. This is distinct from an objective in pure science, which is another phase of the matter altogether." Speaking of the work of the Honorary Advisory Research of Canada, Mr. Gilmour understood that one of its functions was to prevent overlapping in the kind of industrial research work which he had in mind. There was at present much waste of effort and time in carrying out researches owing to scattered workers or groups of workers being engaged on the same problems. Success in eliminating this multiplication of effort depends entirely on the co-operation of the interested parties and breaking down the habits of secretiveness which are too often carried to extremes.

Regarding the training of young men who intend to apply themselves to industrial careers, Mr. Gilmour is satisfied that they must combine with the scientific or academic side of their studies, experience and training in the technical or industrial side before they can hope to become successful or really useful. To obtain this, Mr. Gilmour, while admitting that he did not know just what had been or was being done in Canada in this regard, stated that the student during his course should have brought home to him convincingly how necessary it will be for him to spend many months at small remuneration in industrial plants before his education is complete. It is essential that the knowledge gained in the laboratory and class-room be put into proper perspective through the influence of large scale manufacturing methods involving, as these do, the practical problems connected with labor usage, accidents and break-downs, economy in materials and stores, value of money and all the rest.

As to the future of chemical industries in Canada, Mr. Gilmour did not care to speak, being, as he said, a newcomer to this country, but he believed that the time had now arrived when the possibilities were great and promising. Canada has hardly begun in the chemical industry. With so many natural resources she has taken the obvious line of least resistance, which is, of course, through these natural resources. Chemical industry is always about the last to get on its feet in a country crying for population.

Mr. Gilmour, when questioned as to his work for the British Ministry of Munitions, said that he was only one of the many thousands who had responded to the call of the Empire, and not the least of whom were the women of the Empire. "Work had to be done quickly. As is well known, our armies were at first starved of the means to

David Gilmour.

put into effect the qualities which they all along possessed in far higher degree than the Germans. The effort throughout was continuous, there as here. Adequate and continuous supplies were at length forthcoming, the enemy were defeated in every field and the whole undertaking was a revelation. I believe that victory would have come much sooner had it not been for the amount of waste there was in every branch at the start of the war." Here Mr. Gilmour paused to say that, "Avoidance of waste should be the watchword of every industrial worker, and in his opinion Germany's whole success in industry prior to the war, and even in the early stages of the campaign, was due to her rigid training in that policy. Manufacturing countries must make this one of their basic principles if they are to compete successfully with the Germany of the future, or, indeed, build up any sort of controlling position in national industries.

"As far as the Standard Chemical Company is concerned," said President Gilmour, "works management and process control by qualified men who have been scientifically and technically trained is one of the fundamentals laid down. No matter what you are doing, you should know when to do it, how to do it, and why you are doing it."

INDUSTRIAL SECTION

Construction, Manufacturing and Market News

British Columbia.

Anyox.—The plant of the Granby Consolidated Mining, Smelting & Power Co. is now in full operation, producing coke in their 32 ovens. Coal is supplied from their own mines on Vancouver Island, while the by-products of the plant include touol, bergol, sulphate of ammonia and coal tar. The coal tar is shipped to Vancouver, where it is fractioned into pitch and creosote.

Kelowna.—Work has commenced on the new refrigerator being built here for the C. P. R. The plant is to cost $25,000.

Port Coquitlam.—The Gregory Tire & Rubber Co. have been granted a $40,000 bonus, also a flat rate of taxation of $200 annually for ten years on the seven and one-half acre site, on which the plant will be erected.

Prince Rupert.—Thirteen carloads of paper were shipped from here to the New York Times, the paper being made from pulp secured from the Queen Charlotte Islands during the airplane wood-cutting industry. The large amount of timber left over was sold to the Pacific Mills at Ocean Falls for the making of newsprint.

Rossland.—The consolidated Mining & Smelting Co. are erecting a concentrator here.

Vancouver.—The Vancouver Pipe & Foundry Co. are reopening their plant after being closed down for six years. Equipment is being installed to operate a ten ton cupola. Colonel J. S. Tait, late O.C. of the 29th Battalion, is reported to have purchased the plant.

The using of the hides of sea lions (seals), of which there are thousands on the west coast of Vancouver Island, for leather for boot and shoe industries, is being urged by Premier Oliver.

The Canada Western Woolen Mills, Ltd., are purchasing two sets of blanket machinery, which will be in operation by January 1st. Wool for blankets and tweeds will be secured from local growers, and the worsted yarns will be made from wool imported from Australia.

The Britannia Wire Rope Co., Ltd., propose to establish a factory on Granville Island for the manufacturing of wire rope.

Manitoba.

St. Boniface.—The Western Wheel Foundries Co., Ltd., will erect a $65,000 foundry.

Winnipeg.—The Northland Knitting Co. are adding two storeys to their present three-storey building.

The Dominion Linseed Oil Co., Ltd., St. Boniface, are making an addition to their plant at a cost of $10,000.

New Brunswick.

Milltown.—Canadian Cottons, Limited, are erecting a large weave shed, 410 x 186 feet, one-storey, costing $50,000.

Moncton.—Davis & Jones are erecting a packing plant here. A two-storey wooden factory building is being erected, and the firm intends to proceed cautiously with the business until it is well established.

Ontario.

Acton.—The electors on October 31st carried the waterworks by-law for $80,000. The plant will include deep wells, pumps, pump house and about four miles of main. The E. A. James Co., Ltd., 36 Toronto street, Toronto, are the engineers. The work will commence at once.

Belleville.—A Canadian company has been formed to manufacture here high-pressure valves, and will utilize the cannery building on South Pinnacle street. The new company is capitalized at $1,000,000, and will take over the business in Canada of the H. A. Wood Manufacturing Co. of the United States.

Cornwall.—The Howard Smith Paper Co. have purchased the Toronto Paper Company's mill here, and will, after making improvements to the plant, manufacture lines that have not been made in Canada to any extent, such as blotting paper and bristol and index boards. It is understood that there will be no change in name of the Toronto Paper Manufacturing Co.

Brantford.—The Slingsby Manufacturing Co., textiles, are making two additions to their plant here at an approximate cost of $200,000. The main mill is being enlarged by an extension, 140 x 100 feet, four storeys. The other extension, 80 x 84 feet, three storeys high, will be a dye-house, and will be equipped with the latest dyeing machinery.

Cobourg.—The Cross Fertilizer Co. of Sydney, N.S., is announced to be seeking a plant site here.

Guelph.—The Taylor, Forbes Co., Ltd., will build an addition to their plant to cost $9,000.

The plant being erected here by the Northern Rubber Co., Ltd., will be ready for operation early in 1920. It is 80 x 200 feet, four storeys, and when completed will have a capacity of 5,000 pairs of rubbers per day.

Galt.—The Riverside Silk Mills have practically completed their new plant.

Hamilton.—The Canada Steel & Wire Co. have commenced the construction of a substantial addition to their plant.

The Norton Company, of Worcester, Mass., have purchased a site here, and are preparing plans for a plant for the manufacture of grinding wheels for use in steel plants.

The Canadian Carbonate Co. of Montreal, has purchased a site here, and will expend $100,000 immediately on buildings and plant equipment.

The Firestone Tire & Rubber Co. of Akron, Ohio, propose to establish a Canadian plant here, a fixed assessment having been granted them.

The British-American Oil Co., Toronto, will erect a $100,000 plant here.

An addition, 70 x 106 feet, three storeys, has been made to the main plant of the Imperial Cotton Co.

The new factory of Provits & Spencer, Canada, Ltd., is practically completed and ready for operation. Textile and paper makers' felts will be the products, and the plant cost in the neighborhood of $1,000,000. It is a branch of the English concern of the same name of Bury, England.

Kitchener.—The Canadian Consolidated Rubber Co., Ltd., have appropriated about $1,000,000 for the enlargement of the plant of the Dominion Tire factory here. Two extensions are being erected, each being 110 x 130 feet, four storeys high, and giving 143,000 feet additional floor space.

Lindsay.—The Horn Bros. Woolen Co. are erecting an addition to their plant, 86 x 60 feet, two storeys, to be used for wool scouring, dyeing raw stock, as well as piece goods, also for picking and blending.

Merritton.—The Interlake Paper Co. have commenced the erection of additions to their plant to accommodate a second tissue paper machine. An extension, 125 x 100 feet, four storeys high, is being added to the beater room, while an extra storey is being placed on the finishing room. Estimated cost, $500,000.

The Canadian Vegetable Parchment Co., Ltd., are erecting a plant here for the manufacture of vegetable parchment paper. This is the first time this product has been made in Canada, the supply hitherto having come from the United States. The plant is 80 x 144 feet, with extension of 50 x 80 feet. Capacity, 16,000 pounds daily of vegetable parchment paper, both plain and printed. The company has an authorized capital of $150,000, and is closely associated with the Garden City Paper Mills Company.

Milverton.—The Town Council have employed the E. A. James Co., Ltd., consulting engineers, Toronto, to prepare plans and specifications for complete water works installations. The plans contemplate deep wells, stand pipe, mains, together with electric pumping plant.

Port Dalhousie.—An enlargement to the plant of the Canadian Consolidated Rubber Co. is planned at a cost of $80,000. A pressure vulcanizing plant, costing approximately $35,000, is one of the chief additions that will be made to the present plant, taking the place of the heater-curing system.

Scarboro.—The Council have instructed the E. A. James Co., Ltd., 36 Toronto street, Toronto, to proceed at once with detailed plans and specifications for an intake, pump house and filter house, with a capacity of 2,000,000 gallons. The plant will be situated south of Birch Cliff, and will serve that part of Scarboro west of the Kennedy Road and south of St. Clair Avenue. Such work as can be done during the winter will be started at once. The installation will cost some $300,000.

St. Mary's.—The St. Mary's Cement Co. have considerably enlarged their plant, a third kiln having been installed, bringing the output up from 600,000 to 900,000 barrels per day.

Toronto.—The Canadian General Electric Co. will build a new warehouse to cost $135,000, at the corner of King and Simcoe streets.

The Canadian Allis-Chalmers Co. will build an electric conduit galvanizing plant, near the corner of King and Simcoe streets, to cost $35,000; dimensions, 650 x 150, one storey.

Quebec.

Chicoutimi.—Price Brothers & Company, according to an announcement by the president, Sir William Price, will commence work without delay on the construction of a large new pulp mill, about four miles east of Chicoutimi. The new plant will have a capacity of between four to five hundred tons per day. The location of the mill will be called "Saquenay."

Montreal.—The Dominion Bridge Company will embark upon the manufacturing of paper mill machinery on a large and permanent scale. Recently large orders have been placed with the Dominion Bridge Company for such machinery by the Laurentide, the Howard Smith and the Interlake Paper Companies.

Approximately $300,000 is being expended by the Steel Company of Canada, Ltd., on enlargement of their plant. New crane runway, forge shop and new finishing and storage buildings in connection with their bolt and nut department, are being erected.

The Eclipse Rubber Co. have commenced the manufacturing of waterproof clothing, employing about 100 hands, at Victoriaville, Que.

United States.

Indianapolis, Indiana.—The Link-Belt Company are making an addition to their Belmont foundry, having under erection a building 400 x 70 feet, as a furnace building. Two new furnaces, each of 15 ton capacity, will be installed, Nos. 7 and 8, but for the present No. 7 only will be installed. The company is also purchasing the necessary machinery, such as rolling mills, sand blast and other foundry equipment needed to take care of the additional capacity. These additions are found necessary to take care of the increasing demand for Link-Belt malleable vim chains for elevating, conveying and power transmission purposes.

RESEARCH PLANT IN BEAUTY SPOT.

The Dorr Co., engineers, New York, Denver and London, two years ago purchased the property known as Sipperley's Mill, about two miles from Westport, Connecticut, at the confluence of the Saugatuck and Aspetuck Rivers, and transformed the historic old mill into a modern research and analytical plant. The mill was built in pre Revolutionary days as a spinning mill, and about seventy years ago was converted into a grist mill, becoming known as Kelly's Mill. Later it changed ownership, though continuing to operate as a grist mill, and was known as Sipperley's Mill. The scope of the work undertaken by the Dorr Company at the "mill" includes analyses of all kinds, extended research along various lines, and the investigation, development, testing and improvement of industrial, chemical and metallurgical processes. The mill has been entirely remodelled and refitted with an attractive library and conference room, sleeping accommodations for transient business visitors, a completely equipped analytical laboratory, and a testing plant of commercial scale tests along many lines. The country surrounding the mill is beautiful and picturesque, and the property has been leased by the State for a Bird and Game Reserve, largely through the efforts and generosity of Mr. Dorr.

INCREASED CHEMICAL PRODUCTION.

A rather recently established company, The Salts & Potash Co. of Canada, Ltd., Kitchener, Ont., is now prepared to place on the market sodium sulphate, magnesium sulphate and carbonate, as well as high-grade salts of potash (chloride, nitrate and sulphate) in such commercial quantities as may be expected to become a factor in Canadian trade in these lines.

This company has developed to the production stage without any of the usual newspaper publicity, and have established their processes on a commercial basis. Salts, obtained naturally in solution or admixture in Saskatchewan, are partially separated and dried and later worked up at Kitchener in their new refining plant.

The officers of the company are A. J. Gough, president; W. W. Sloan, vicepresident; J. Klotz, secretary-treasurer; J. E. Day, solicitor; W. G. Weichel, managing director; C. Ide, production manager; and C. W. Hancock, chemist in charge.

Everyone must wish this company success, because their aim is along the lines so necessary to the complete working up of Canadian resources with the Dominion.

Canadian Government Publications

By S. J. COOK

(Note: Recent Government publications of scientific, technical or educational value are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.)

HONORARY ADVISORY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH OF CANADA.

Report of the Administrative Chairman for the year ending March, 1919. 66 pp.

More important as a historical review of the beginnings of research in Canada than as a story of great accomplishments during the year, this report of the Administrative Chairman of the Advisory Council presents a series of the "acorns" planted during the year, some of which may yet grow to be the mighty oaks so much desired in the scientific world. Sixteen pages of the report give in brief the activities of the Research Council as seen by the chairman, and in the pages which follow there are appendices giving in greater detail the work of the various branches of the Council's endeavors. The several sub-committees had an active year and their work is recorded in this latter part of the booklet. The expenditures of the Council amounted to $61,151.62 out of a vote of $120,000. The amount actually spent on studentships and fellowships was $7,150, although it was estimated that this item would run to $17,000. The report as a whole will be read with interest by all interested in the subject of national scientific advance.

COMMISSION OF CONSERVATION.

Power in Alberta. By James White. 32 pp. An address delivered by Mr. White at the Industrial Congress, Calgary, August, 1919. The resources of the Province in the way of water, coal and natural gas are reviewed and the data available on the subject are thus conveniently gathered together in one pamphlet for easy reference by those interested. The last six pages are given to a note by Mr. L. G. Denis on "Nitrogen Fixation," and the known processes are compared and described.

DOMINION BUREAU OF STATISTICS.

Monthly Bulletin of Agricultural Statistics. September, 1919.—Reports of crops and estimates of yields for Canada, together with weather reports, data regarding British imports of butter and cheese, and the prices of grain complete the bulletin.

Monthly Report of the Trade of Canada for September.—Imports and exports of Canada by articles and principal countries for the month of September and for the six months ending September for the current year and also for 1918. This publication, complete within six weeks from the date it carries, is looked forward to by an increasing number of business men who find in it a guide to the trend of trade not given elsewhere and the fact that it is up-to-date adds considerably to its usefulness. The matter is well indexed, and the many sub-totals enable the reader to obtain quickly any data required.

Central Electric Station in Canada. xliv, pp. and 27 pp., 7 diagrams. Prepared in collaboration with the Dominion Water Power Branch and various provincial organizations.

This bulletin is issued as part of the Census of Industry for 1917, and includes all stations in Canada developing electric power for sale. The complete report is being published in two sections, the first part by the Dominion Bureau of Statistics and comprising the satistical data; the second part by the Dominion Water Power Branch, and containing a directory of the commercial and publicly owned power stations reported as in operation in Canada, showing the principal features of each, the locations where blocks of electrical energy are for sale, the price at which such power is available, transportation facilities in the vicinity of each station, etc.

The two sections of the report are being issued in uniform volumes, Part One being distributed by the Dominion Bureau of Statistics and Part Two (containing the Directory) by the Dominion Water Power Branch.

The introduction and summary prefacing Part One gives data on primary power equipment, generating equipment, employees, salaries and wages, financial statistics, fuel consumption and the total water power development in Canada. The last item, namely, the total water power development in Canada, is complete to the end of 1918, the data necessary for this being taken from another census taken by the Bureau in conjunction with the Water Power Branch, and it takes account of the development up to January 1, 1919. It is stated that Norway and Sweden are the only countries where the per capita consumption of electric power is greater than in Canada. The text of the report is in both English and French.

COMMERCIAL INTELLIGENCE BRANCH.

Weekly Bulletins Nos. 821-825.

Page 829. Condition of the glass industry in Belgium. Before the war, Canada was Belgium's third best customer. Prices for Canada are quoted and the glass firms ready to ship are listed. Canada's importation of Belgium glass for the three years, 1911-12-13, were respectively 19.4, 18.9 and 15.6 kilos. It will be interesting to note whether Canadian factories will now be able to compete further with the Belgian houses.

Page 982. Belgium is not in a position to export chemicals to Canada. Her present exports are in the ratio of 1 to 40 when compared with 1913.

Pages 1033-1042. A full report by W. McL. Clarke, showing under what conditions trade with Spain may be worked up. Although not particularly optimistic, Mr. Clarke seems to have prepared a clear and comprehensive report on the subject which will be of considerable value to any firms thinking of cultivating Spanish trade.

Page 1046. The attention of makers of automobile tires is directed to the fact that Great Britain imported largely from Germany in 1914, and that at present authorities in the United Kingdom are looking forward to a "tire famine."

DEPARTMENT OF HEALTH.

Food and Drug Laboratory.—Bulletin 435. Diabetic Foods. 9 pp. Definitions of gluten flour products are recommended as a result of this and previous examinations made by the Food and Drug Laboratory of these foodstuffs. The suggested standards are closely similar to those prevailing in the United States and include such commodities as ground gluten; gluten flour; gluten flour, self rising; and "diabetic food." The products now sold by the vendors of these foods are certainly not up to the requirements on the average, as the report under review states. Dr. McGill hopes that the wide distribution of this report will serve the useful purpose of educating the people who have occasion to buy such preparations so that they will, by their own knowledge, compel the dealers to be intelligently informed on this important subject. Analyses, trade names and the names of the manufacturers making the samples analyzed are given in the bulletin.

Bulletin 433. Seidlitz Powders. 9 pp. One hundred and ninety-eight samples of seidlitz powders were analyzed and

151 were found to meet the requirements of the United States Pharmacopoeia, as regards percentage composition. Ten samples were found adulterated under the Act, the cause being the substitution of bi-carbonate of soda for Rochelle Salt in the blue paper. The soda is about ten times cheaper than the Rochelle Salt. One hundred and forty-four samples were found to fall outside the acceptable limits of error in weight, the departure being between five and ten per cent., and it is pointed out that this indicates carelessness in weighing, which ought not to be so characteristic.

DEPARTMENT OF MINES.

Geological Survey.—Summary Report, 1918, Part E, 45 pp., 7 figs., 1 map. The Canadian National Railways between Longuelac and Oba, in Northern Ontario, served as a hunting ground for Mr. T. L. Tanton during the field seasons of 1916 and 1917. His report consists of a general statement, a review of the general geology, and a record of the mineral occurrences in the area. The second paper in this Summary is by Mr. W. H. Collins and deals with the ore deposits of Goudreau and Magpie-Hawk areas in Michipicoten District. The Geological Survey entered this field in 1918 with the intention of aiding prospecting and development operations for the purpose of securing for Canada increased supplies of pyrites because foreign sources were cut off and the price had raised so much as to make it seem profitable to investigate the deposits which had been known for twenty years, but had not been developed for economic reasons. The district is described, but it is pointed out that the opinions formed and here expressed must be regarded only as tentative, and that much further work must be done. This work seems justifiable from the results already attained. Gold has also been found distributed throughout the area. The third paper deals with the oil fields of southwestern Ontario, and is by Mr. M. Y. Williams. It is a review of field work carried on in 1918, and gives the reader a very clear idea of the work and development of these oil fields. It is indicated that more care is being taken to conserve the natural resources of this district than was formerly observed, and that as a result it seems not too much to say that the wells now operating will continue to do so for some time. It seems that the district was much overdrilled at first and that the bad effect of this extravagance is now being felt. The use of compressed air and centralized drilling has not yet been resorted to in this district. The Petrolia region has been, and is yet, with the exception of Mosa township, the largest producing field in Canada, according to the report. A statement of oil production in Ontario during 1918 is included. The total amount is given as 10,106,615 gallons, of which Mosa produced 3,814,591 gallons.

TABLE SHOWING IMPORTS INTO CANADA FOR THE MONTH OF SEPTEMBER (1918 AND 1919), OF LEADING ACIDS.

NOTE—Except where otherwise stated the quantity is in pounds.

Imports from	Boracic Acid. 1918.	1919.	Muriatic Acid. 1918.	1919.
United Kingdom ..	....	....	....	....
United States	13,124	27,605	5,691	9,388
	Nitric Acid. 1918.	1919.	**Sulphuric Acid.** 1918.	1919.
United Kingdom ..	....	1,120	....	....
United States	5,557	5,332	1,049,430	232,244
	Acetic Acid, Crude Not over 30% strength. 1918.	1919.	**Oxalic Acid.** 1918.	1919.
United Kingdom ..	....	....	....	....
United States Gal.	241	725	340	12,879
	Stearic Acid. 1918.	1919.	**Tartaric Acid, Crystals.** 1918.	1919.
United Kingdom ..	....	....	1,344	26,130
United States	1,609	10,078	13,881	7,590

Total value of imports of all acids for September, 1918: From the United Kingdom, $7,630; for September, 1919, $42,376. From the United States for September, 1918, $53,028; for September, 1919, $40,304. From other countries, September, 1918, none; September, 1919,

Table Showing Imports of Dyes and Tanning Material for the Month of September (1918 and 1919) from United Kingdom and United States.
(Quantity given in pounds.)

	Analine and Coal Tar Dyes, including Aligarine. 1918.	1919.	Analine Dyes. 1918.	1919.
United Kingdom ..	....	41,244	....	....
United States	88,656	150,454	1,402	315
	Analine Oil, Crude. 1918.	1919.	**Coal Tar Base (Paranitranaline)** 1918.	1919.
United Kingdom ..	....	....	....	....
United States	....	17,222	5,805	3,104
			Analine Salts. 1918.	1919.
United Kingdom			....	....
United States			559	....

Total value of all dyes and tanning materials imported during September, 1918: From United Kingdom, $375; from United States, $247,810. During September, 1919, from United Kingdom, $24,061; from United States, $347,976. From other countries, September, 1918, $10,440; September, 1919, $66,162.

Fertilizers.

Total value of all fertilizers, including manufactured, superphosphate, unmanufactured, guano and manures, kainite and crude potash salts, and phosphate rock, imported from the united Kingdom during September, 1918 and 1919, none; from the United States, September, 1918, $54,284; September, 1919, $67,003.

Paints, Pigments and Varnishes.

Total value of all paints, pigments and varnishes, imported during September, 1918, from the United Kingdom, $18,313; from the United States, $210,288; from other countries, $3,125. During September, 1919, from the United Kingdom, $27,766; from the United States, $338,689; from other countries, $6,973.

Inorganic Chemicals.

The imports of some of the more important inorganic chemicals during September are as follows:

	Copper Sulphate, (Lbs.) 1918.	1919.	Magnesium Sulphate, (Value). 1918.	1919.
United Kingdom ..	....	....	....	$ 511
United States	58,907	41,312	....	5,385
	Potassium Chlorate, (Lbs.) 1918.	1919.	**Soda Ash, (Lbs.)** 1918.	1919.
United Kingdom ..	....	....	952,000	78,400
United States	2,272	36,426	5,849,150	6,282,344

Total value of imports of all inorganic chemicals during September, 1918, from United Kingdom, $74,821; from United States, $732,799; from other countries, $194,760. During September, 1919, from United Kingdom, $40,846; from United States, $562,586; from other countries, $19,240.

Total value of all imports of all chemicals, and allied products, during September, 1918, $2,875,509; during September, 1919, $2,933,087.

Exports.

Total value of asbestos products exported from Canada during September, 1918, $805,182; during September, 1919, $989,615.

Total value of coal exported in September, 1918, $643,389; September, 1919, $1,059,360. Of the latter, $442,751 was exported to the United States.

The exports of mica show a large increase for September, 1919, as compared with September, 1918. In September, 1918, mica exports were valued at $11,885, and for September, 1919, $42,248, of which the United States received by far the largest amount. (See article on mica in this issue.)

Of petroleum oil and its products, $91,331 was the value exported in September, 1918, and $97,245 in September, 1919, of which $65,051 went to the United States, though the reverse was true in September, 1918, when $53,999 worth was exported to the United Kingdom, largely for war purposes.

Export of Acids.

Sulphuric acid, September, 1918, $3,205; September, 1919, $16,587. Total export of acids, September, 1918, $3,205; September, 1919, $41,542.

Export of pharmaceutical preparations, drugs, for September, 1918, $77,442; September, 1919, $133,558.

Export of fertilizers: September, 1918, $293,541; September, 1919, $302,332, of which practically all went to the United States.

Soaps.—A large increase is noted in exports of soap, the value having advanced from $3,487 for September, 1918, to $135,889 for September, 1919.

Total exports of inorganic chemicals for September, 1919, are valued at $590,580, as compared with $429,762 in September, 1918.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemical Journal by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Process of Making Acetone.

Harold A. Morton, 194062, November 18, 1919. Acetic acid vapors are subjected at an elevated temperature to the action of a catalyst containing Mn.

Bleaching Powder.

Alfred Rudge, 194216, November 25, 1919. Lime and Cl are caused to move in counter current through a very long externally cooled cylindrical space in which the solid is agitated and prevented from adhering to the surface of the container by being lifted within a thin partial annular zone not immediately adjacent to the surfaces of the container.

Solder for Aluminum.

F. F. Boisselier, 193568, November 4, 1919. Solder consists of Al 28, Zn 36.5-37.5, Sn 33 and Cu 2.5-1.5%.

Manufacture of Methyl Alcohol.

J. A. Christiansen, 193945, November 18, 1919. CH_2CHO_2 is treated with H in the presence of a catalyst such as reduced Cu at a temperature of about 180° to produce CH_3OH.

Matches.

Maurice J. MacMahon, 194001, November 18, 1919. A double-headed match with nitches at two intermediate points with a substance such as water glass on the splint between the nitches.

Explosives.

F. M. Becket, 193387, October 21, 1919. The explosive contains an oxidizing agent and a Mg-Si alloy.

The Concentration of Ores.

E. Edser, S. Tucker, 194278, November 25, 1919. In the differential separation of metallic particles of ore a pulp is made of the ore with water, a small proportion of the Na_2SiO_3 and a soluble soap is added and the pulp aerated to produce a froth selectively floating certain particles which are separated, the remaining pulp is diluted with water and aerated to produce a second froth.

Aluminum Solder.

C. L. Bonsteel, 193926, November 18, 1919. The solder is composed of Sn 29 pounds, Zn 11, Phosphor Sn 2, Al 2, Bi 2 grs.

Aluminum Solder Flux.

C. L. Bonsteel, 193927, November 18, 1919.

Solder Flux.

Chas. L. Bonsteel, 193928, November 18, 1919. A solder flux consists of Ox lard 40, resin 40, sesame 20, $ZnCl_2$ 12 and water 12 parts.

Extraction of Lead from its Ores.

F. E. Elmore, 193958, November 18, 1919. In brine processes for extracting Pb from its ores the brine is cooled to 0° either before or after removing the Pb salts to remove the Na_2SO_4, which is used preferably in hot solution to convert the Pb salts into $PbSO_4$ free from chlorides.

Bearing Alloy.

Wm. D. Berry, 193567, November 4, 1919. An alloy contains Cu 60-85, Pb 1-35, Sb 3-20%, P (0.25 to 3%) may be added.

Metallic Alloys.

F. S. Hodson, 193464, October 28, 1919. The alloy contains Zn 80-85, Al 18-14 and Cu 2 to 1 parts.

Concentration of Ores.

H. L. Sulman and E. Edser, 194276, November 25, 1919. In the froth-flotation process of concentrating ore a soluble soap is used as the universal frothing agent, and the mixture of ore pulp and soap is aerated to form froth. A small proportion of a substance which will cause the gangue to become melted but will not decompose the soap may be added to the pulp.

Concentration of Ores.

E. Edser and L. Sulman, 194277, November 25, 1919. In the froth-flotation process of concentrating ores the tendency for the gangue to be floated with the mineral value is overcome by adding a silicic acid solution to the pulp or to the ore in milling.

Cutlery.

Harry Brearley, 193550, October 28, 1919. A practically untarnishable alloy for cutlery purposes, is composed of Fe containing 9 to 16% Cr and less than 0.7% C.

Explosive Mixture.

Roy L. Hill and A. J. Straue, 193399, October 21, 1919. Five-tenths to 10% of $CuSO_4$ from which the water of crystallization has been wholly or partially removed is added to explosives made up wholly or in part of NH_4NO_3 and an organic nitrate to prevent the explosive from becoming hard, unless frozen.

Explosive Mixture.

Roy L. Hill and A. J. Straue, 193310, October 21, 1919. The explosive consists of $CuSO_4$ from which the water of crystallization has been removed and NH_4NO_3.

Dissolving Sodium Silicate.

E. A. Taylor, 194265, November 25, 1919. Finely divided soluble silicate is maintained in a quiescent condition and heated in the presence of water with steam until the required strength of solution is obtained.

Softening Water.

E. Edser and S. Tucker, 194279, November 25, 1919. Salts producing hardness in water are pptd and removed by adding a small proportion of soluble soap, agitating and aerating the mixture to form a froth carrying the pptd salts and removing the froth.

Wm. G. Leamon—Methods of treating gases containing hydrogen sulfid, 193994, November 18, 1919.

J. C. Adell—Process of preparing highly oxidized manganese compounds, 193311, October 21, 1919.

H. L. Sulman and W. B. Ballantine—Alloys, 193561, November 4, 1919.

A. Kissock—Alloy steel, 193623, November 4, 1919.

J. W. Dougherty—Method of preventing gas explosions in blast furnaces during temporary stops, 193587, November 4, 1919.

J. W. Dougherty—Method of blowing down and blowing out blast furnaces, 193586, November 4, 1919.

A. J. Moisant—Process for ozonizing substances, 193688, November 4, 1919.

Lewis B. Skinner—Ore smelting, 194224, November 25, 1919.

THE DEVELOPMENT OF THE BASQUE CHEMICAL PRODUCTION CO.

Mr. R. Pinchin, Vice-President and General Manager of the Ontario Oil and Turpentine Co., Ltd., Toronto, has been elected Director of the Basque Chemical Production Co., Vancouver, B.C. This Company now controls perhaps the largest known body of pure magnesium sulphate.

Extensive drilling operations have been carried out on their salt deposits at Basque, B.C., and it is estimated by the engineers in charge that at least 21,000,000 tons of magnesium sulphate are available.

This firm is already shipping in car-load lots to Ontario points, where the natural salts have been found to be of the highest purity and quite suitable for industrial purposes. The Ontario Oil and Turpentine Co. are distributors of this product for the Dominion of Canada.

QUEBEC ZINC INDUSTRY.

The Federal Zinc and Lead Co., of Montreal, announce that their development work is progressing very favorably. The property of the Company consists of claims situated near Brandy, and Berry Mountain Brooks, Lemieux township, Gaspe county, Quebec. About 1,200 acres have been staked, and three shafts sunk on various veins. Some 8,000 tons of ore are on the dumps. Several representative assays have been made, and it is estimated that the ore will run at least $6 per ton in zinc and $4 per ton in lead —on an 8 per cent. zinc and 4 per cent. lead analysis. While further development awaits the sale of stock, there are the best of indications that with proper management and transportation, a new industry of importance to Quebec will shortly be at the producing stage.

POTASH FROM CEMENT MILLS.

Several Portland cement factories in the United States which have installed plant for the recovery of potash from their flue dust are said to have recouped the capital costs during the first year of working. In 1917, about 45 per cent. of the total production of potash was derived from brines, about 10 per cent. from kelp, nearly 9 per cent. from charred molasses residues, and about 5 per cent. from cement mills. Cement mill production of potash in 1918 was equivalent to 1,429 tons of pure potassium oxide.

Chemical, Oil, and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

It was not to be expected that industries such as the coal and steel could be long interfered with by labor conditions, strikes and idleness, without the chemical industries being effected. Such has been the case, and the results of the coal miners' strike in the United States are being felt in the Canadian chemical industries perhaps to a greater extent than many realize or even think probable. One of the largest concerns in the heavy chemical trade in the Dominion has placed a three-months' limit on all contracts, as beyond that period they consider it unwise and foolish to promise delivery. Coal must be had for our acid plants, for our fertilizer plants and for the caustic soda works, as well as practically all the so-called heavy chemicals.

As predicted in last month's report, there have been no lowering of prices on chemicals, but slight increases are noticeable, more so on small orders, than on large ones. The volume of business carried through at Toronto and Montreal during November was slightly in excess of October returns, and while no large movements were noted, yet, take it on the whole, the amount of trade done was not at all discouraging. It is true that greater business was looked for during November, and under normal conditions this would have been realized, but labor conditions undoubtedly curtailed shipments and buying. However, it is the opinion of practically every one in the trade, that just as soon as the coal strike is settled and industrial conditions return to normal, the chemical trade as a whole is due for a strong, healthy, and active period. All signs point to this; plants are ready for greater production and buyers are waiting for opportunities to place orders when conditions are normal.

Acids.—The price of the sulphurics, nitrics, muriatics, and other acids has remained at practically the same level as last month. If the coal supply is not increased very soon, the sulphuric acid plants will be greatly handicapped. In the table of exports of chemicals from Canada, given in this issue on another page, it will be noticed that there was a large quantity of acid exported during September. Needless to say, this was not a normal or regular action of the trade, as normally practically no acid is exported from Canada, other than acetic. The figures in part represent a large amount of acid which a large Canadian concern had on hand and which was shipped to a Buffalo company. Doubtless, also, a large quantity of the acid which the Imperial Munitions Board had in reserve following the armistice and which was sold to United States firms is also included in these export figures.

Soda Ash.—Mixtures of soda ash and bicarbonate of soda in varying strengths are declared by a recent decision of the Canadian Customs Board to be dutiable under tariff item 711, which places a duty of three-tenths of a cent a pound on soda ash. The placing of these mixtures of soda ash and bicarbonate of soda on the dutiable list settles rather an interesting point, which was debated by commissions at Ottawa for many years. These mixtures, mostly "cleaning" mixtures, are now decided to be soda ash, or at least to be listed under tariff items referring to soda ash, and this is how most chemical men believe they should have been classified long ago.

Pharmaceuticals.—In pharmaceuticals and drugs, the tendency in prices is to remain firm and in most cases to advance. This is notable in the bromides, which have all advanced and the market is very strong. Supplies of camphor are scarce and the price high. There is a firm market in glycerine with an advance likely, an advance of a half cent per pound was made during the month, glycerine in drums now selling at 25 cents per lb. Asperin has advanced from $1.20 to $1.30 per lb. during the month.

METALS.

Silver.—On November 26, bar silver was quoted in New York at $1.36¼ per ounce. This quotation was based on the demand for the precious metal from China. For some time past, China has been a very heavy purchaser of silver, the demand being attributed to requirements for settlement of New Year obligations on February 1, but it is not improbable that Chinese banks are buying for speculation. In any event, the fact is that at the end of November we find China practically controlling the silver market. Companies mining silver combined with lead, zinc, or copper, are doing a good business, as lead and zinc are selling above pre-war quotations.

Copper.—There has been but little activity in the copper market of late. The uncertainty of labor conditions has had perhaps as much to do with creating this situation as anything else. Prices at Toronto and Montreal are slightly lower than last month, being down about one-half cent per lb. (See quotations on next page.)

Fluorspar.—Canadian fluorspar, containing 85 per cent. calcium fluoride, is quoted at $25 per ton, delivered. Fluorspar containing 73-78 per cent. calcium fluoride is quoted at $22 to $24 per ton f.o.b English ports. It is interesting to note that the Consolidated Mining and Smelting Company of Canada are making preparations which are almost completed for the refining of fluorspar from their Rock Candy mine in British Columbia, so as to turn out a product suitable for acid and chemical manufactures.

Steel.—Much interest has centred of late in the steel industries of Canada, and, provided labor conditions remain steady, the Canadian steel industry has an excellent future. Reports from the different mills throughout the Dominion are most encouraging, and this is reflected on the good standing of the steel companies on the stock exchange. The Canadian trade is, of course, dependable upon United States mills for sheet steel, and as these mills are unable to meet their own demand the supply of sheets for Canada is falling far below requirements. Premiums are being given for prompt delivery and on common iron bars quotations on prompt delivery were raised $5 above the regular price some ten days ago. The price of steel sheets has advanced, due to strong competition for the sheets by automobile manufacturers, black sheets having gone as high as $8 and $11 over the regular market. Orders for black and galvanized sheets are being accepted at Toronto and Montreal, with deliveries expected soon after New Year's.

FLOTATION OILS AND NAVAL STORES.

Turpentine.—The firm market that has prevailed in turpentine during the past four months still continues. Prices at Toronto are holding steady at $2.35 per imperial gallon from the jobbers. The holding up of the Peace Treaty by the U. S. Senate is still keeping the European export

market closed, and if something does not happen soon one may look for some of the turpentine now in storage for European shipment getting into the American and regular home market.

Linseed.—Linseed oil shows firmness, though future quotations are much lower than December 1st prices.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

Acetanilid, C. P.	Lb.	$ .. — .70
Acetic acid, commercial, crude, 28% in bbls.	Lb.	.04½—.05½
Acetic acid, refined	Lb.	.18½—.19½
Acetone	Lb.	.18½—.23½
Acid phosphoric, specific gravity 1.750	Lb.	.. — .52
Aspirin, in 100-lb. lots	Lb.	1.20— 1.25
Alcohol, pure, bbl., 65% O.P.	Gal.	.. 8.25
Alcohol, methylated, bbl.	Gal.	.. 1.35
Alcohol, wood, 95%, refined, bbl.	Gal.	2.25— 2.50
Alum, Ammonia, lump	100 Lbs.	.. 5.75
Aluminium Sulphate, high grade, bags	100 Lbs.	3.25— 3.50
Ammonia, Aqua 26	Lb.	.09— .12
Ammonium Carbonate	Lb.	.. .17
Ammonium Chloride	Lb.	.15— .20
Amyl acetate, technical	Gal.	5.00— 5.50
Amyl acetate, pure	Gal.	6.00— 6.50
Arsenic	Lb.	.. — .09
Barium Sulphate (Barytes)	Per Ton	38.00—40.00
Benzoic Acid	Lb.	.. 1.15
Bleaching Powder, 35% drums	100 Lbs.	3.25— 3.50
Borax, crystals	Lb.	.10— .11
Boric Acid, powdered	Lb.	.17— .18
Caffeine, English	Lb.	.. — 8.50
Calcium Carbide, in carload lots	Per Ton	.. —85.00
Calcium Carbide, per single ton	Per Ton	.. —90.00
Calcium Carbide, less than ton lots		.. —96.00
Calcium Chloride, fused	Per Ton	26.00—30.00
Carbolic Acid, white crystals	Lb.	.22— .25
Carbon Bisulphide, in drums	100 Lb.	.. — .10
Carbon tetrachloride, drums	Lb.	.20— .24
Caustic Soda, ground, bbl.	Lb.	.04¾—.05¼
Chloroform	Lb.	.45— .55
China Clay, imported	Per Ton	20.00—25.00
Citric Acid, domestic, crystals	Lb.	.. — 1.15
Cobalt Oxide, black	Lb.	— 1.50
Copper Sulphate (Blue Vitriol)	Lb.	.10—.10½
Cream Tartar, 98%	Lb.	.. — .60
Formaldehyde	Lb.	.. — .28
Formic Acid, 75%	Lb.	.40— .42
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fusel oil, special	Gal.	5.00— 5.25
Fusel oil, refined	Gal.	6.00— 6.25
Glycerine, drum, C.P.	Lb.	.. — .25
Hydrofluoric Acid, 60%	Lb.	.. — .22
Hydrofluoric Acid, 30%	Lb.	.. — .11
Hydrochloric Acid, carboys, 18	Lb.	.02½—.02¾
Lead Nitrate	Lb.	.16— .18
Lithopone	Lb.	.09½—.10½
Magnesite, calcined	Per Ton	.. —25.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl.	Lb.	.18— .22
Magnesium Sulphate	Lb.	.04¼—.04½
Magnesium Sulphate, B.P.	Single Ton	.. —70.00
Magnesium Sulphate, B.P., in car lots	Ton	.. —50.00
Muriatic Acid, 18 to 22	100 Lb.	2.00— 2.85
Naphthaline flake	Lb.	.10— .11
Nitric Acid, 36 carboys	100 Lb.	.08¾—.09½
Oxalic Acid	Lb.	.35— .37
Oleic Acid	Lb.	.. — .23
Potassium Bicarbonate	Lb.	.. — .41
Potassium, Bromide, crystals	Lb.	.. — 1.10
Potassium, Bromide, granular	Lb.	.. — 1.00
Potassium Hydroxide (Caustic Potash, 100 to 500-lb. lots		.. — .44
Potassium Hydroxide (Caustic Potash), 25 to 100-lb. lots		.. — .42
Potassium Hydroxide (Caustic Potash) Sticks		.. — 1.50
Potassium Nitrate, kegs	Lb.	.22— .24
Potassium Permanganate, bulk	Lb.	.75— .85
Phenacetin	Lb.	3.10— 3.25
Quinine	Oz.	1.02— 1.50
Salicylic Acid	Lb.	.75— .90
Silver Nitrate	Lb.	12.00—14.00
Soda Ash, bags	Lb.	.03—.03½
Sodium Acetate	Lb.	.14— .16
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.34— .35
Sodium Nitrate, refined	100 Lbs.	6.75— 7.00
Sodium Nitrate, crude, 95%	100 Lbs.	5.00— 5.50
Sodium Benzoate	Lb.	1.00— 1.10
Sodium Bicarbonate, 100% pure	100 Lb.	3.50— 4.00
Sodium, Bichromate, bbls.	Lb.	.19— .20
Sodium Nitrite	Lb.	.15— .16
Sodium Hyposulphite, kegs	100 Lb.	4.25— 4.75
Sodium Silicate, according to density	100 Lbs.	3.00— 3.50
Sodium Sulphate (Glauber's Salts) crystals	Per Cwt. in Bags	.. — 1.65
	Per Cwt. in Car Lots	.. — 1.60
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.00— 4.25
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.50— 2.70
Sumac extract liquid, dark	Lb.	.. — .08
Sumac, extract liquid, colorless	Lb.	.. —.17½
Sumac, powdered	Lb.	.31— .35
Sumac, extract, No. 2	Lb.	.. —.10½
Sodium Bisulphite, 35	Lb.	.. —.02½
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Lb.	.. —17.00
Tannic Acid, commercial	Lb.	.70— .75
Tartaric Acid, crystals or powdered	Lb.	.75— .80
Tin Chloride, crystals	Lb.	.47— .50
Zinc Sulphate, com.	Lb.	.. —.06½
Zinc Dust	Lb.	.13—.14½

Metals.

Aluminium, No. 1, 98-99%	Lb.	.32— .40
Antimony	Lb.	.. —.09⅞
Brass, yellow ingots	Lb.	.. — .20
Brass, red	Lb.	.. — .24
Cobalt, metal	Lb.	.. — 2.50
Cobalt Oxide, grey	Lb.	.. — 1.70
Copper, casting	Lb.	.. —.23½
Copper, electrolytic	Lb.	.. —.24½
Copper, electrolytic, in car lots	100 Lb.	.. — .24
Iron, common	Base Price 100 Lb.	.. — 5.00
Lead	Lb.	.. —.07¾
Lead, in car lots	Lb.	.. —.07½
Magnesium	Lb.	1.75— 2.25
Mercury	Lb.	.. — 2.50
Nickel, shot or ingot	Lb.	.40— .45
Platinum, pure	Oz.	147.00—150.00
Silver, bar	Per Troy Oz.	..—1.36¼
Spelter	Lb.	.. — .10
Spelter, in car lots	Lb.	.. —.09¾
Steel, mild	100 Lb.	.. — 4.50
Steel, nickel, in bars, 3½% nickel	100 Lbs.	.. — 7.00
Steel, sheet, Bessemer, 28 gauge	100 Lb.	8.15— 8.50
Tin	Lb.	.. —.56½
Zinc, sheets	Lb.	.09¾— .10

Oils and Coal Tar Products.

Motor Gasoline	Gal.	.. — .32
Motor Gasoline (service stations)	Gal.	.. — .35
Lighting Gasoline	Gal.	.. — .37
Naphtha	Gal.	.. — .31
Coal Oil	Gal.	.. —.20½
Fuel Oil	Gal.	.. — 7.00
Mid. Continent Crude (42 W. gal.)	Bbl.	.. — 2.25
Pennsylvania, crude (42 W. gal.)	Bbl.	.. — 4.25
Crude Creosote Oil	Bbl.	16.00—18.00
Refined Creosote Oil	Bbl.	20.00—22.00
Crude Coal Tar	Bbl.	.. — 7.25
Refined Coal Tar	Bbl.	.. — 8.50
Coal Tar Pitch, in Bbls.	Ton	.. —24.00
Benzol, pure	Gal.	.24— .28
Refined Solvent Naphtha	Gal.	.20— .25
Pure Toluol	Gal.	.25— .30
Dip Oil, 20 per cent.	Gal.	.38— .40
Crude Carbolic Acid, 30 per cent.	Gal.	.. — .75
Naphthalin flake	Lb.	.. — .12
Naphthalin Balls	Lb.	.. — .13
Alpha-Naphthylamin	Lb.	.45— .50

Flotation Oils and Naval Stores.

Spirits of Turpentine, in bbl. lots..(Imp.)	Gal.	.. — 2.35
Rosin, Grade G, in 280 bbl. lots		.. —25.00
Rosin, Grade W.W., in 280 bbl. lots		.. —28.00

Gums and Vegetable Oils.

Vegetable Oils—

Anise Oil	Lb.	2.10— 2.25
Castor Oil (Medicinal), in bbl. lots	Lb.	.. — .35
Castor Oil (Commercial), in bbl. lots	Lb.	.30— .32
Cocoanut Oil (Refined)	Lb.	.. — .32
Linseed Oil, raw, in bbl. lots....(Imp.)	Gal.	2.30— 2.40
Linseed Oil, boiled, in bbl. lots ...(Imp.)	Gal.	2.33— 2.43

Gums—

Indian, No. 1A	Lb.	.. — .44
Indian, No. 1	Lb.	.. — .42
Tragacanth, No. 1, Ribbon	Lb.	.. — 5.00
Tragacanth, No. 1, Flake	Lb.	.. — 4.75
Tragacanth, Turkey	Lb.	.. — 4.25
Arabic, clear amber sorts	Lb.	.. — .21
Arabic, regular grain No. 4 and No. 5	Lb.	.. — .22
Arabic, regular grain No. 2	Lb.	.. —.22¼
Arabic, white sorts	Lb.	.. — .40
Arabic, powdered, No. 1	Lb.	.. — .40
Arabic, powdered, No. 2	Lb.	.. — .39

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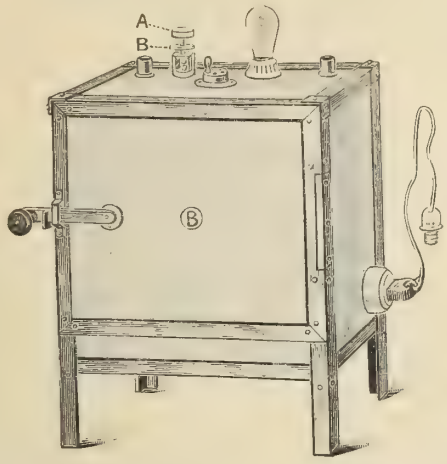

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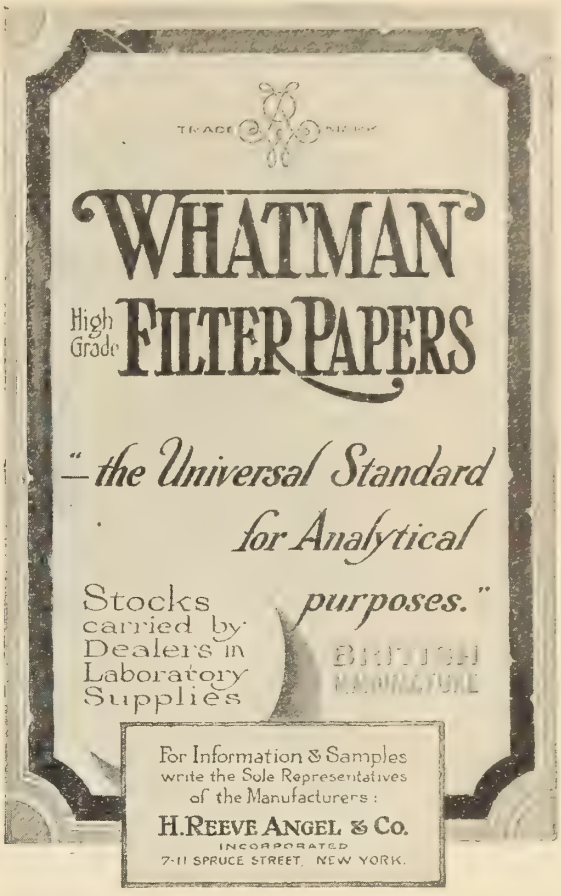
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TP-1640-A. Two Ingersoll-Rand Air Compressors, type X-4. Capacity 1,000 cu. ft. free air per minute at 75 lbs. pressure. Right steam cylinder 14″ x 16″, left steam cylinder 14″ x 16″. Air cylinder 14″ x 16″. These Compressors are new—have never been used.

BOILERS.

ON-1705-A. Seven 150 H.P. Locomotive Type Boilers. 60″ dia. x 20′, 164-2½″ x 12′ tubes. 100 lbs. pressure.

CARS.

ON-1746. 160,000 lb. Gondola Car, made by Dominion Coal & Foundry Co. Standard gauge. Capacity 1586 cu. ft. or 160,000 lbs. 38′ 4″ long overall, inside length 36′ 6″. Steel body and frame, drop bottom. Air brakes.

ON-1747. Two Standard Gauge Flat Cars. 35′ long, capacity 40,000 lbs.

ON-1748. Thirteen 36″ Gauge Transportation Trucks. Steel frames, galvanized iron lined wooden box. Roller bearings.

ELECTRIC LOCOMOTIVES.

ON-1745. Two 5-Ton Storage Battery Locomotives. Made by Atlas Car & Manufacturing Company. 36″ gauge, 800 lb. draw bar, full speed 5.2 miles per hour. 40 cells MV-13 iron cald U.S.A. Oxide storage battery. Capacity, 190 amperes.

TP-1640-J. Four 36″ Gauge Electric Locomotives. Storage battery, capacity 8-10 tons, weight 3,600 lbs. "Type AA," manufactured by Automatic Transportation Company. 4′ wide x 5′ overall length, complete with batteries, etc. We also have 4 extra sets of batteries for these Locomotives.

TP-1640. Four 36″ Gauge Industrial Tractors. Automatic Transportation Company "Type S", rubber tired wheels, capacity 5-7 tons, weight 2,400 lbs. 3′ 1″ wide x 4′ long overall, complete with 30 A-4 Edison cells with each Locomotive.

ELECTRIC FREIGHT ELEVATORS.

ON-1701. Five Electric Freight Elevators. 12′ 0″ travel, 3,000 lbs. live load. Platform 5′ x 8′ 4″. Complete with 5 H.P. 3 phase, 60 cycle, 550 volt, squirrel cage motor.

ON-1702. Two Electric Freight Elevators. 27′ 0″ travel, platform 7′ x 6′. 6,000 lb. live load. 7.5 H.P. induction motor, 3 phase, 60 cycle, 550 volt.

ON-1703. Tandem Electric Freight Elevator. 18′ 0″ travel, 8,000 lbs. live load. Platform 6′ 6″ x 10′. 7½ H.P., 3 phase, 60 cycle, 550 volt squirrel cage motor.

ON-1704. Single Lift Hydraulic Freight Elevator. 10′ lift, 4″ ram, platform 48″ x 72″.

EXHAUST FANS.

ON-1718. Three Niagara Concidal Exhaust Fans, made by Buffalo Forge Company. Overhung, steel housed, belt driven, type N. Right hand bottom horizontal discharge 4′ x 5′ 4″ x 6″ header and approximately 1728′ 1″ pipe coil connected to fan inlet and cast iron steam headers with combination flanges, 525 RPM. Complete with power system.

ON-1720. Five Buffalo Forge Company 97 low pressure Gas Exhaust, with 16″ horizontal bottom discharge direct connected to 4″ spiral steam turbine with governor.

ON-1721. Five Buffalo Forge Company No. 4 Low Pressure Gas Exhausts, with 10″ horizontal bottom discharge direct connected to No. 2 spiral steam turbine with governor.

HEATING AND COOLING UNITS.

ON-1719. Five Heating and Cooling Units. Made by F. L. Patterson & Co., New York. Plate shells with brass tubes, complete with 450 sq. ft. heater, and 100 and 150 sq. ft. coolers and exhaust fans. (Exhaust fans listed under **ON-1718, 20, 21.**)

HYDRAULIC ACCUMULATOR.

ON-1729-A. Southwark Hydraulics Accumulator, 11′ dia. x 12′ 6″ high, 5-16″ boiler iron shell with 7-8″ iron bottom, 7′ deep, 10′ lift. Complete with cast iron base, control valve, pipe, etc.

METAL BINS.

ON-1744. Forty Galvanized Toncan Metal Steel Frame Bins, 66″ square x 42″ deep, with copper bottoms 48″ square x 30″ deep and 8″ square and 11″ deep. Cast iron nose with molasses gate.

MIXERS.

ON-1726. Seven Werner & Pfleiderer Size 15, Type 6 BB, Universal Tube Mixing and Kneeding Machines. 100 gals. working capacity. Complete with driving gears, tight and loose pulleys, copper hopper, etc.

TP-1640-F. Fifteen Werner & Pfleiderer Size 15, Type 6, Class BB Mixers. Special nitro cellulose construction with jacketed troughs. Working capacity, 100 gals. These Mixers were used for but a short time and are all in excellent condition. Customers who have already bought some of these express themselves as thoroughly satisfied with these machines in every way. Our price is considerably under 50 per cent. of their value new to-day.

TP-1640-B. Six Darling Brothers Mixers. Same specifications as above. Troughs 33″ x 7½″ x 30″ deep. Made to Warner & Pfleiderer specifications by Darling Bros. of Montreal, Canada.

TP-1640-S. Paul O. Abbey Mixer. Cast iron trough 30″ x 27″ x 33″ deep with 7-8″ ends. Fully jacketed with covered cast iron jacket. 4 blade agitator.

PRESSES.

ON-1724. Four Southwark Hydraulic Finishing Presses. Stock cylinders cast steel 12″ x 36½″, water cylinders cast steel 18″ x 72½″. Complete with brass head, steel ram, corner posts, steel screen plates and connecting piping.

ON-1723. Four Southwark Hydraulic Blocking Presses. Stock cylinders cast steel 11¾″ x 35″, water cylinder 11¾″ x 36″, with brass plungers. Complete with cast steel cover, cap valves and connecting piping.

ON-1722-B. Three Southwark Hydraulic De-Hydrating Presses. Copper lined stock cylinders 16″ x 47″. Complete with four corner posts, control valves, etc.

ON-1722-A. Three Southwark Hydraulic De-Hydrating Presses. Copper lined steel stock cylinders 16″ x 47″, water cylinder 16″ x 55½″. Complete with four corner posts, control valves, etc.

DEHYDRATING PRESSES.

TP-1640-N. Six De-Hydrating Presses, manufactured by E. I. Du Pont de Nemours. Forms cake 16″ dia. x 8″ thick. Cylinder 20″ x 40″, 3,500 lbs. pressure per square inch.

PUMPS.

ON-1709. Worthington Horizontal Duplex Fire Pump, 18½″ x 29″ x 16″ x 18″. Capacity 2,000 GPM against 150 lbs. water pressure with 100 lbs. steam pressure.

ON-1710. Worthington Horizontal Compound Duplex Fire Pump, steel rods, 14″ and 20″ x 11″ and 15″. Capacity 1,000 GPM against 150 lbs. water pressure and 80 lbs. steam.

ON-1711. Four Duplex Horizontal Bronze Fitted Steam Piston Pumps, brass rods, cast iron primer, 6″ x 2½″ x 6″. Made by Gardner Governor Company, Quincy, Ill. Good for 300 lbs. pressure.

ON-1712. Five Worthington Horizontal Duplex Bronze Fitted Steam Piston Pumps, 3″ x 2″ x 3″. Steel rods.

ON-1713. Six Worthington Horizontal Duplex Bronze Fitted Steam Piston Pumps, 5¼″ x 4¾″ x 5″, steel rods.

ON-1714. Two Worthington Horizontal Duplex Bronze Fitted Steam Pumps, 5¼″ x 4¾″ x 5″, steel rods. Used for ether and alcohol.

ON-1715. Blake-Knowles Single Horizontal Bronze Fitted Steam Piston Pumps, 3½″ x 3½″ x 4″. Steel rods. Used on caustic soda solution.

ON-1729-B. Deane 2½″ x 12″ Vertical, Triple, Geared, Hydraulic Pumps. Direct connected Canadian Westinghouse 50 H.P., 3 phase, 60 cycle, 550 volt induction motor.

ON-1716. Alberger 3 Stage Horizontal Twin Turbine Pump. Capacty 480 GPM against 290′ head. Direct connected to 50 H.P. Canadian G. E. induction motor, 3 phase, 60 cycle, 550 volt.

CENTRIFUGAL PUMPS.

ON-1730. Two Cast Iron Centrifugal Brine Pumps, 4″ suction x 3″ discharge, bronze impeller, direct connected to Fairbanks-Morse 10 H.P., 3 phase, 60 cycle, 550 volt motor.

RETORTS.

ON-1706-A. Twelve "Buflovak" Cast Iron Nitric Retorts, 8′ dia. x 10′ high inside. Capacity, 6,000 lbs. nitrate of soda charge. New; have never been used.

SMOKE STACKS.

ON-1705-B. Four Steel Stacks, 30″ dia. x 78′ high, 3-16″ plate. Approximate weight 3980 lbs. each.

ON-1705-C. Steel Smoke Stack Breeching, 3′ 6″ x 9′, 5′ 6″ x 10′ 6″ and 70′ long, 1-16″ plate.

CLOSED VERTICAL STEEL TANKS.

ON-1735. Four Closed Vertical Steel Tanks, 2′ 6″ dia. x 5′ high, ¼″ plate, capacity 180 gals.

ON-1736. Four Closed Vertical Steel Tanks, 9′ 6″ dia. x 10′ high, ⅜″ plate, 5,300 gals.

ON-1737. Eleven Closed Vertical Steel Tanks, 15′ dia. x 12′ high, 5-16″ plate, capacity 16,000 gals.

ON-1738. Two Closed Vertical Steel Tanks, 18′ dia. x 12′ high, 5-16″ plate, capacity 28,000 gals.

CLOSED HORIZONTAL STEEL TANKS.

ON-1742. Two Closed Horizontal Steel Tanks, 7′ dia. x 36′ long, 7-16″ plate, capacity 10,000 gals.

ON-1739-A. Three Closed Horizontal Steel Tanks, 7′ dia. x 26′ long, ¼″ plate, capacity 7,500 gals. Closed horizontal steel tank 7′ dia. x 26′ long, 5-16″ plate, capacity, 7,500 gallons.

ON-1740. Two Closed Horizontal Steel Tanks, 8′ dia. x 31′ long, ⅜″ plate, capacity, 11,000 gals.

ON-1739-B. Closed Horizontal Steel Tank, 7,500 gals. capacity. 7′ dia. x 26′ long, 5-16″ plate.

OPEN TYPE VERTICAL STEEL TANKS.

ON-1741. Open Type Vertical Steel Tank, 15′ dia. x 12′ high, ⅜″ plate, capacity 15,000 gals.

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ON-1743-A. Seven Thousand Wooden Trays, 2′ x 2′ 8″ x 3″ deep, with wire bottoms. Have been used, but are in excellent condition.

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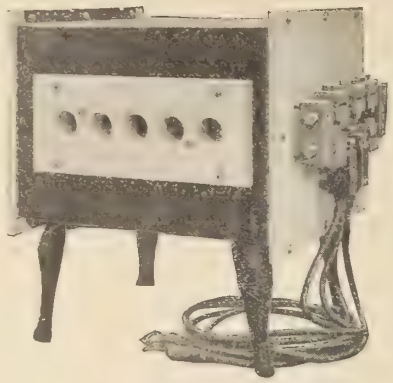

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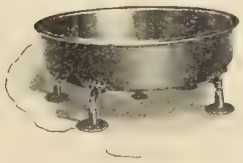

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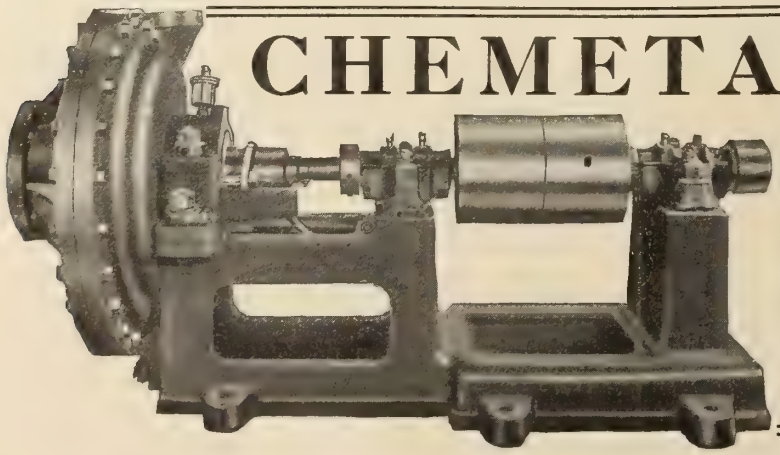

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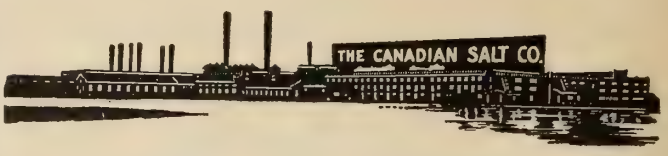

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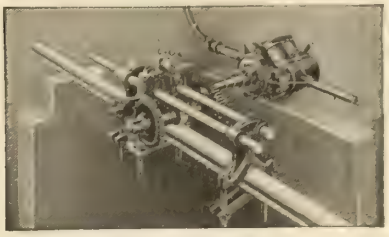

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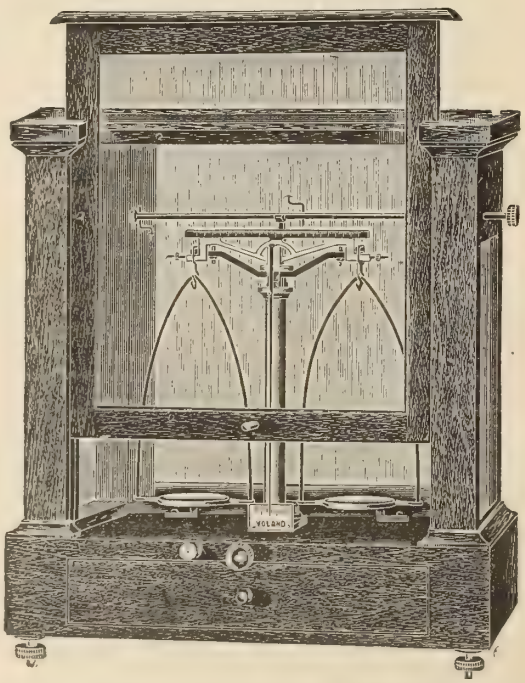

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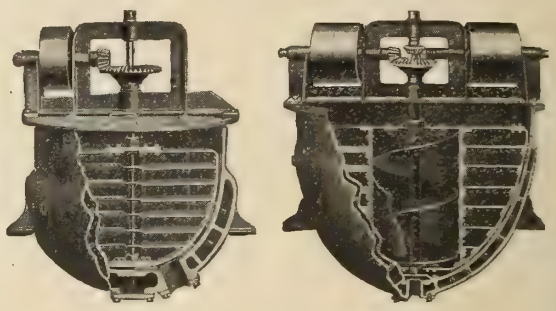

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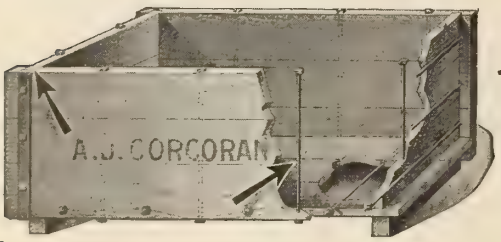

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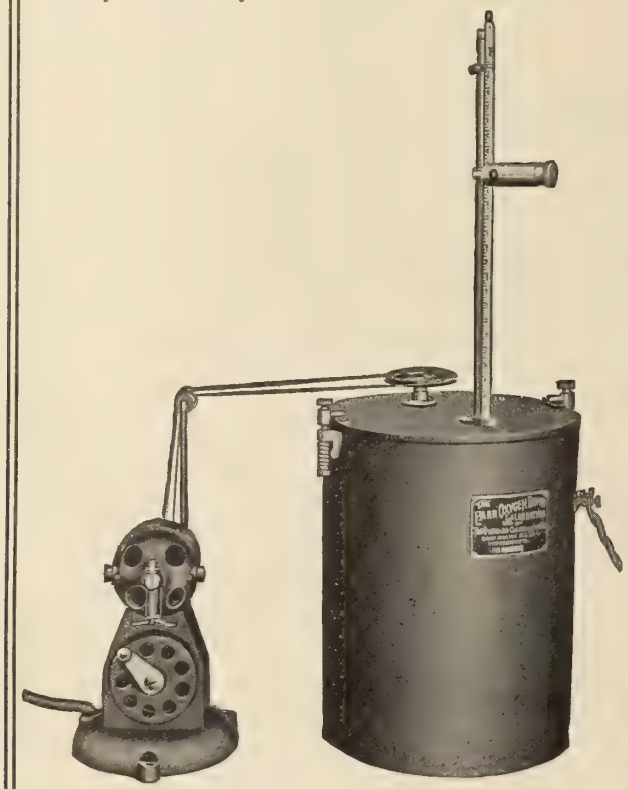

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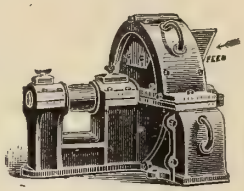

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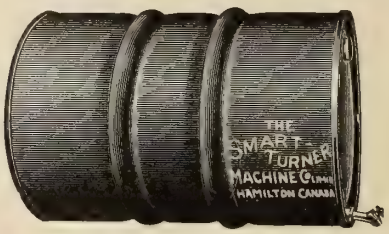

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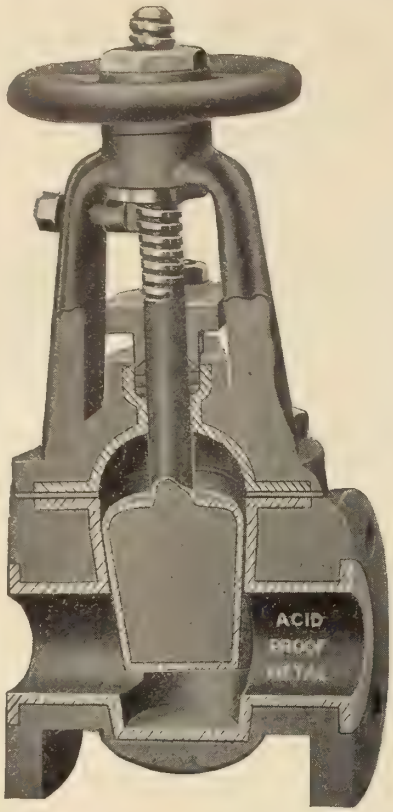

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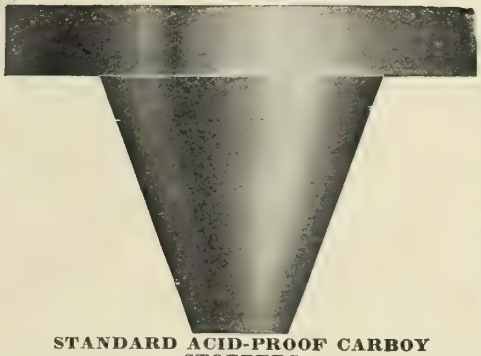

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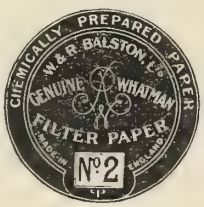

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